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QUARTERLY

OF THE

National Fire Protection Association

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National Fire Protection Association

INTERNATIONAL

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Over 4,400 Associate Members

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Reports of fires appearing in the Quarterly are copies of or extracts from written reports forwarded to the Association. This Association, as a body, is not responsible for the statements or opinions of any of its members.

Factory Mutual Record.

The Pittsburgh gas holder explosion on November 14 killed twenty-eight people and caused property damage estimated at $10,000,000. This picture shows the exploded gas holder in the center and the ruins of the Pittsburgh Clay Pot Co. plant in the left foreground. **(See report on page 213.)**

The Quarterly

Vol. 21 January, 1928 No. 3

The 1927 Fire Loss. The statistics of the fire loss for the year just closed as compiled by the New York *Journal of Commerce* and reported on another page of this QUARTERLY may be cited as convincing evidence of the success of the fire prevention campaign. For a dozen years the annual fire loss has been increasing progressively without a single let-up, with the sole exception of the year 1919, which had losses somewhat lower than the preceding year that had shown extra large losses owing to war conditions. After such a long period of progressively increasing losses the decrease in the past year cannot be considered as a mere fortuitous and temporary drop. The saving is large enough to take on a real significance. The decrease may be due in part to favorable business conditions and like factors, but it is evident that in the main it is the direct result of fire prevention efforts.

Year after year we have been comforting ourselves by calculations to show that though the fire loss increased, the rate of rise was not so great as the rate of increase in total property values exposed to destruction by fire and that the losses, while greater in terms of dollars and cents, have been decreasing in relation to the total property value. The validity of such calculations has not been questioned, but they are not nearly so convincing as the absolute reduction in the fire loss which has now been registered.

It should be noted that the estimates of the *Journal of Commerce* are usually about one-third smaller than the statistics compiled by the Actuarial Bureau of the National Board of Fire Underwriters and published a year later. The *Journal of Commerce* figures are, however, quite generally accepted for comparative purposes, and while the final statistics for the year 1927 published a year from now may vary considerably from the present figures, there can be no doubt as to the correctness of the trend shown by the present estimates.

Fire prevention has not yet progressed to the point where we have any right to count on a continuing downward trend in fire losses next year on the basis of the 1927 experience, but the results obtained in individual cities which have taken fire prevention seriously point the way to the enormous reduction in our fire waste that may be anticipated when the whole country has become thoroughly imbued with the fire prevention idea.

Architects and Fire Prevention. The architect is not held personally responsible for defects in design causing the rapid spread of fire or loss of life, but it is a general postulate in fire protection circles that the fire waste would be greatly reduced if only the architectural profession could be educated to design buildings with due regard for fire walls, the protection of vertical openings, fire-stopping and like details. We perhaps have been expecting too much of the architect, who, after all, is merely the agent of the owner. It seems unreasonable to hold the architect wholly responsible for the incorporation in his plans of fire safety features which are neither appreciated nor wanted by his client. A typical case is reported involving a prominent New York architect who submitted plans of a proposed building showing two enclosed stairways. The client asked, "Why two stairways?" The architect replied, "It is not safe to rely on a single stairway as a fire exit, it might be impossible for people to reach it. Two stairways are needed for safety."

"Does the law require it?"

"No."

"Put in nothing except what is required by law."

Such has been the attitude of the public that it perhaps has not been worth while from the viewpoint of the architect to study the subject of fire safety much beyond the details of building code requirements. But as the awakening public becomes more discriminating and demands real built-in fire safety rather than mere minimum compliance with rules and regulations, the architect may be expected to develop the necessary fire prevention consciousness and to consult the fire protection specialist just as he now consults the foundations expert, the heating and ventilating engineer, and the structural engineer in their respective fields.

* * * * *

Conditions in Our Second City. The régime of Chicago's spectacular mayor, William Hale Thompson, commonly knows as "Big Bill," is having other effects not so generally known as is his war with King George of England. One important and serious effect of the chaotic political situation in the city is the disregard of civil service requirements. Chief Seyferlich of the fire department, a well-liked and able chief, was removed from office on November 2nd. The position of fire chief under the law is a civil service position. This has been a comparatively simple matter to evade, however. Upon the death of the late Chief Buckley in 1924, Chief Seyferlich was given a temporary sixty-day appointment and since that time he has been reappointed at sixty-day intervals. The new chief will be kept in office by the same procedure, presumably, thereby retaining the office under executive control.

On December 13 an effort was made to have city fire prevention engineer, John Plant, superseded in authority. Mr. Plant is also a civil service appointee, so the plan was to create a new appointive position of division marshal in charge of the fire prevention bureau, thus placing the bureau under political control. It is highly probable that this plan will have succeeded by the time this QUARTERLY appears in print.

A short time ago all of the builders and contractors in Chicago received a letter from the Building Commissioner Paschen suggesting that they should join the William Hale Thompson Club (membership $100 per year). They all joined. A week before Christmas the six thousand odd city policemen were instructed to join Mayor Thompson's America First Foundation at $10 each. Probably the firemen will come next.

The Mayor's flair for showmanship was well demonstrated when the time came to test out a new fire department pumper. He found an old four-story building in the "Chicago loop" which was to be torn down, secured permission from the owners, and ordered the fire department to fill it with combustible material and burn it. This highly dangerous procedure was protested in a letter to the Mayor by one of our field engineers who happened to be in Chicago. The protest was carried in and supported by the Chicago newspapers, but without effect. The building was set afire on November first. Fortunately no damage was done to surrounding property and no firemen were injured or killed.

* * * * *

Christmas Tree Fires. The Christmas tree fires of the past holiday season have in many cases been reported as due to electric tree-lighting systems. This represents a great change from a few years ago when the candle was the most prevalent cause of fire at this season and when electric lighting equipments for Christmas trees were almost unkonwn.

Fire protection authorities have consistently advocated the use of electric lights in place of the highly hazardous candles on trees, and the persistent educational efforts along these lines, together with the development of modern tree-lighting sets, have now made it appear that the Christmas tree lighted by candles, particularly in our larger cities, is quite the exception. Electricity as a means of Yuletide illumination is infinitely safer than the wax candle, but that defective wiring on Christmas trees, just as anywhere else in a building, may cause fires is forcefully shown by the record of the past Christmas season. Two deaths in Chicago as a result of a Christmas tree fire, and the hasty exit of nine hundred patients from the Massachusetts State Hospital in Worcester during a Christmas celebration, are typical cases. Responsibility for fire safety does not stop with the substitution of electricity for candles on trees, for tree wiring sets should be maintained in proper condition just as wiring of any other kind. The way in which these fires occurred has not been very

clearly shown by the reports received. The tinsel so largely used as tree decoration coming in contact with exposed live parts might easily cause a short circuit generating sufficient heat to ignite the tindery tree. Another theory is that these Christmas tree lighting sets, preserved in homes from year to year, may now have been in use long enough so that they are showing the effects of age and wear so that the insulation on the individual wires is not in proper condition.

The lesson of these fires which have occurred during the past holiday season seems to be two-fold, first, that the occurrence of fires due to electric wiring on trees should not be allowed to shake the public confidence in the inherent superiority of electric illumination over candles, and second, that the electric tree lighting outfits should be carefully inspected and installed to minimize the potential hazard which will continue to exist as long as highly combustible trees covered with flammable decorations are used in celebrating Christmas.

* * * * *

The New England Flood. During the first few days of November a record breaking rainfall occurred in Vermont and adjoining New England states, causing the loss of one hundred and forty lives and more than thirty million dollars in property damage. The details of this disaster were so fully reported in the newspapers and periodicals that no further description of the damage is needed here. A feature of this flood which has not been emphasized to any great extent is the serious effects which it had upon fire protection. The carrying away of dams, washing out of water mains, interruptions to power supplies for pumping, and the impassability of streets and roads to fire apparatus left individual manufacturing properties and in some cases whole cities without fire protection for periods of days or weeks. That no conflagration occurred in the flooded area is probably due to the special attention given to fire prevention during the period when fire extinguishing facilities were out of commission. There were a number of individual building fires within the flooded area, and one fire of some importance in a warehouse in Becket, Massachusetts, but in view of the enormous aggregate amount of property which was wholly or partially without fire protection during this period the absence of serious fire loss is very gratifying.

From the viewpoint of the individual manufacturing property this flood emphasized the importance of independent private fire protection and the danger of placing sole reliance upon public protection which is always subject to interruption by some unforeseen disaster. The importance of secondary supplies for automatic sprinkler systems is particularly evident in a case such as this, also the value of independent motive power for fire pumps, not dependent upon a municipal electrical system and so located as not to be affected by flood.

Hay Barn Fires in the Flooded Area. While no conflagrations and few fires in city buildings occurred during the Vermont floods of last fall, there was a considerable number of fires in isolated farm buildings. The energetic Chairman of our Committee on Farm Fire Protection, Mr. D. J. Price of the U. S. Department of Agriculture, went at once to the flooded area in Northern Vermont for the purpose of making observations on farm fires with a view to the development of methods of prevention. The floods wetting hay in barns developed conditions favorable to spontaneous ignition, and the resulting fires were difficult if not impossible to control because the floods made the usual fire protection facilities unavailable. As the water receded in the Winooski, Lamoille and Missisquoi river valleys the wet hay began to heat. In one instance reported by Chairman Price a barn had been submerged to a depth of seventeen feet. When the water receded to a depth of about five feet a spontaneous ignition fire occurred. Mr. Price and his associates were able to make some very valuable observations which indicate definitely the need for further research to determine the factors contributing to spontaneous ignition of hay in barns and the development of control methods.

* * * * * *

Radio Dialogues on Fire Prevention. Mr. George F. Lewis, Deputy Fire Marshal of Ontario, has introduced a new idea in public instruction in fire prevention—namely, a dialogue over the radio. He staged a little drama, in fact, in which he starts out to deliver an address but is soon interrupted by the entrance of a woman friend who presents the appearance of having been through a terrible fray. On being questioned by him, she relates how she had been cleaning a dress with gasoline in her kitchen and the gasoline exploded. She is burned and bandaged (as is conveyed to the audience) and has met with considerable loss through the accident. After her excitement seems to have calmed down somewhat, the conversation settles down to a general discussion of home fire hazards, the lady asking the questions as they occur to her and the speaker answering them with instructive and informing responses. The broadcasting station received reports and information from various sources, showing that the dialogue had been heard with great interest and appreciation.

Undoubtedly a dialogue affords far greater opportunity for vivacity, informality, humor and appeal than does a progressive address. This is true of a dialogue on any subject, but especially true of such a subject as fire prevention, which, to admit the unfortunate truth, does not readily capture the public interest when in competition with a variety of other diversions.

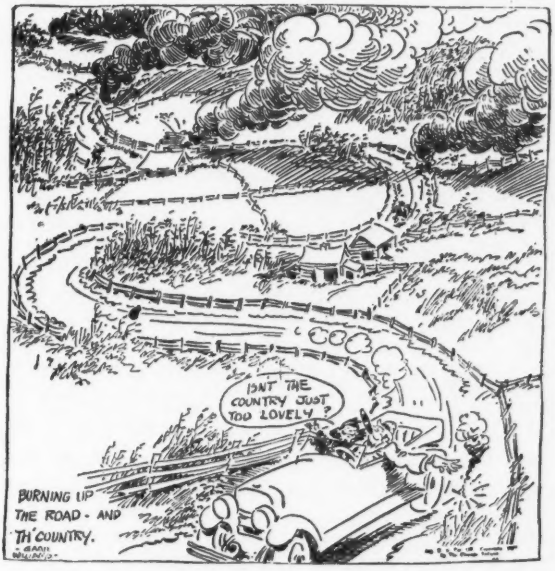
Under the method of the dialogue, fire prevention instruction becomes a diversion. If it is a good dialogue the radio audience will listen to it with pleasure. It will realize that it is swallowing the sugar-coated pill, but it will swallow it just the same and like it.

Observations on Water Throwing. Criticisms are frequently made that American fire departments as a whole are too prone to use long range fire-fighting methods, flooding whole buildings indiscriminately rather than applying the water to the seat of the fire and avoiding water damage to unaffected portions of the structure. A communication received from Axel u. Wisenberg, Fire Chief of the State Railways of Finland, is illuminating evidence of how American practices may be regarded by the European student of fire protection.

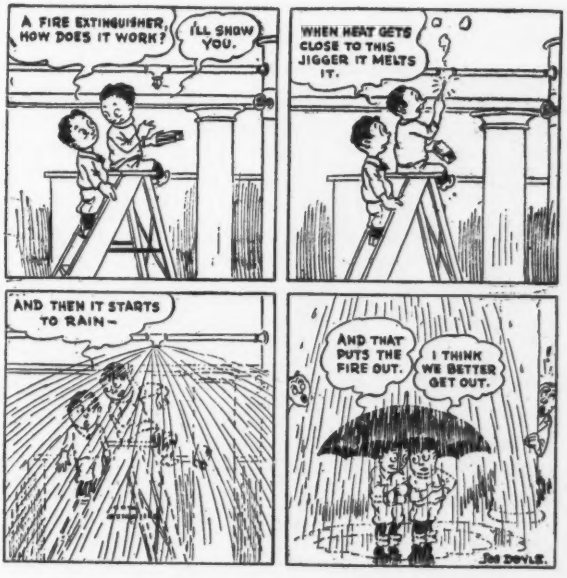
It is quite natural, that fire-fighting in different countries is carried on in somewhat different forms, depending on various local circumstances; in the construction of buildings, training of fire brigades, available fire-fighting apparatus, etc. There is however, one special feature with regard to the putting out of fire, again and again appearing in the numerous pictures in the QUARTERLY, which undersigned is unable to understand. Will you please look at page 148, 171, 186, 189, in the last number of the QUARTERLY (Vol. 21, No. 2). I wonder just how many per cent of the water actually is touching the burning parts of respective buildings? One should think that the walls are burning, and not the interior of the constructions. By fires in our good town there seldom is to be seen any jets of water, as they are applied on the proper places, by attacking the fire from the inside of the buildings. In some instances this method of fire-fighting is combined with some risk for the firemen, but in most cases it can easily be done, and is by every means the most effective way of gaining victory.

It may seem arrogant for a foreign member to criticise fire-fighting methods used in "the great West," but I think the matter should be worth while discussing. Both methods have most likely their special advantages, but they cannot be equally good. Let us try to find out which method is the more effective.

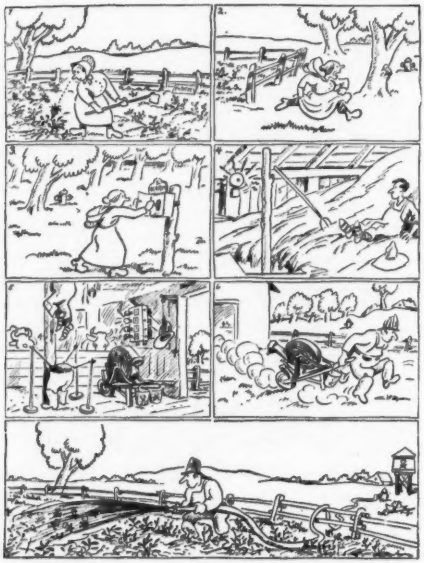
Mr. Wisenberg perhaps overlooks the many exceptions that might be cited to his general indictment, but we must admit that in the main his criticism is all too just.



Gaar Williams in the Chicago *Tribune*


A FIRE EXTINGUISHER, HOW DOES IT WORK?
I'LL SHOW YOU.
WHEN HEAT GETS CLOSE TO THIS JIGGER IT MELTS IT.
AND THEN IT STARTS TO RAIN—
AND THAT PUTS THE FIRE OUT.
I THINK WE BETTER GET OUT.
Joe DOYLE.

Joe Doyle in the Philadelphia *Inquirer*



The Fireman Who Went "Back to the Farm."
—*Life*

Uncle Sam: "Can't fool me; ain't no such animal."
—*Whittlings*

The Consumer's Burden.
—*Whittlings.*

The Pittsburgh Gas Holder Explosion.

Newspapers have told of the terrific explosion which shook a section of Pittsburgh on the morning of November 14. A large gas holder was entirely wrecked. Thirteen men at work repairing the tank were instantly killed and few traces of them have been found. Fifteen other persons in the vicinity also lost their lives, and several hundred were injured. (See Frontispiece.)

Near-by buildings were demolished and two adjacent holders were ripped open. Four-ton steel pieces were hurled eight blocks. The rain of metal débris tore holes in roofs. Window glass more than a mile away was broken. Ten million dollars is the probable total loss.

The explosion stirred up an immense cloud of dust which darkened the air. It neatly folded back the roof of the larger of the two near-by holders and gas escaped upward in a light-colored tumbling cloud. A mile and a third away a Weather Bureau man, attracted to his office window by the boom of the explosion, saw this cloud rise five hundred feet, saw it flash into flame, and saw it burn intensely for two or three minutes. Shortly afterward, the radiation of the resulting heat wave was plainly felt through the window.

The wrecked holder stored natural gas and had a capacity of five million cubic feet. It was of the common telescopic type, likened to an inverted collapsible drinking cup set in a dish of water (see diagram, page 214). When empty, the "lifts" nest in a tank filled with water, and rise as gas is pumped in. A water seal between sections makes the joints gas-tight.

The water tank of the exploded holder was about thirty feet high and held about seven million gallons. When the explosion tore open the tank sides, nearly all of this water and about one-half from the large adjoining holder flooded streets and basements in the vicinity, hampering relief work and giving rise to the belief that large street mains had broken.

About one-fourth of the holder frame remains erect after the explosion. It is on the side away from the river. This would indicate that the greatest force of the explosion fortunately was vented across the stream. Greater damage and greater loss of life probably would have otherwise occurred.

Repairs had been in progress on this holder for many days, in preparation for which it had been emptied. A holder full of gas cannot explode, but a mixture of gas and air can cause a violent explosion. Gas companies often use steam in blowing out the last traces of gas, and then any back leakage is prevented by closing double valves with open bleeders between on the inlet and outlet pipes, and further by filling the vertical sections of these pipes

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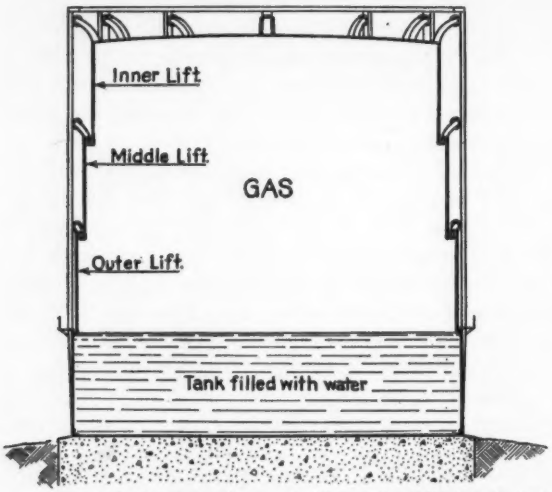
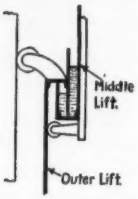
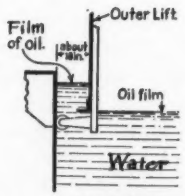
From *Factory Mutual Record*, published by the Inspection Department of the Associated Factory Mutual Fire Insurance Companies. (Member N.F.P.A.)

Only fifty feet away, this sprinkler tank is still standing, probably because the inertia of the mass of water resisted the explosion force.

A giant skeleton of disaster. Only about one-quarter of the gas holder frame was standing after the explosion.

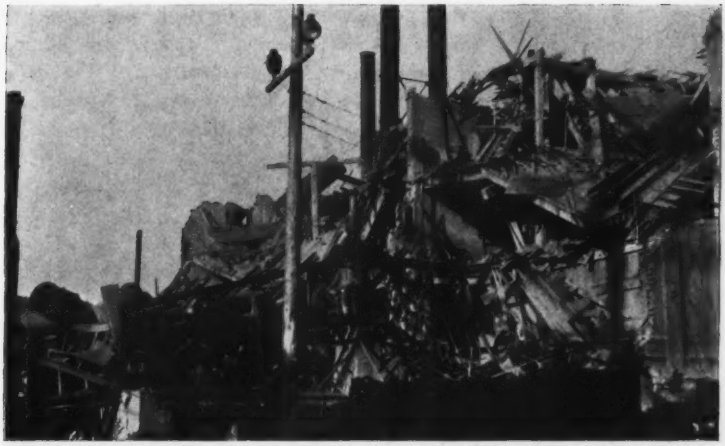






DETAILS OF WATER SEALS.

A typical telescopic gas holder. The Pittsburgh holder was 200 feet in diameter and 208 feet high. The water tank held seven million gallons.



Demolished buildings of the Pittsburgh Clay Pot Company, at the nearest point about twenty feet away from the exploded gas holder. Seven men were trapped in the basements of these buildings, and then drowned when water from the holders poured in.

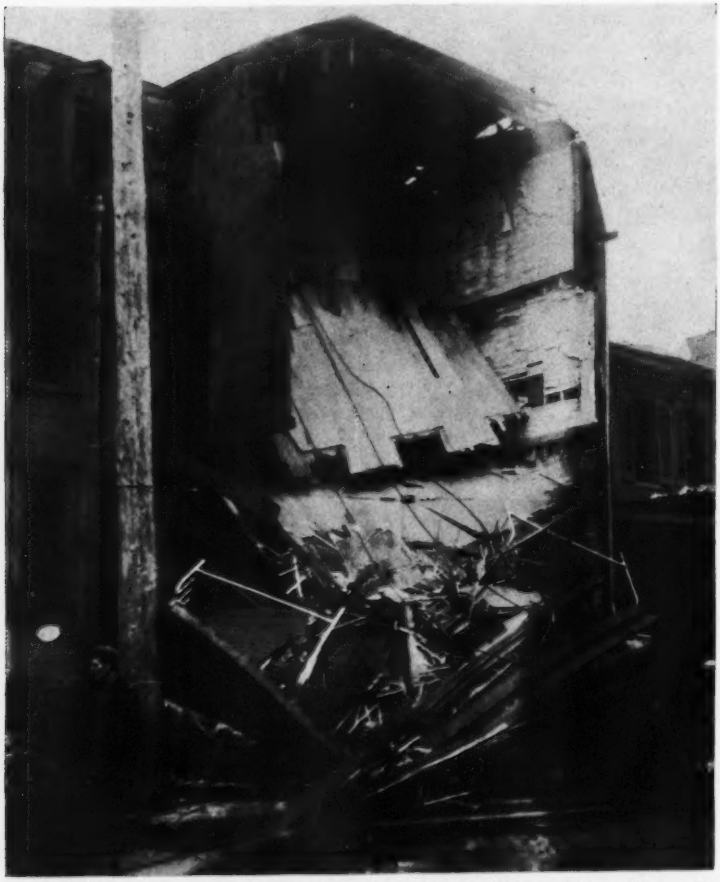
inside the holder with water. Air is then pumped into the holder to raise the "lifts" and make them accessible for repairs.

With these precautions taken, the chance of an explosive mixture existing in the holder is remote. It would appear that an explosive mixture formed in some way in the Pittsburgh holder and was ignited by an acetylene torch in the hands of one of the workmen. This is the first serious gas-holder explosion on record, and only two or three minor explosions have been reported previously. There have been a few fires from the ignition of oil and tar collecting on the water seals of gas holders, but no great damage was caused. There have been a few fires at holders from gas leaks or from the rupture of plates due to rust, but outside the gas equipment itself the damage caused was small. The thousands of gas holders which have been in use throughout the country for many years show that the inherent hazard from explosion or fire is small.*

Of the near-by buildings severely damaged, those of the Pittsburgh Clay Pot Co. fared worst. Several buildings, one four stories high and only forty feet away from the explosion, were entirely wrecked. One end of another four-story building was torn open and roofs of still other buildings were demolished. Interior partitions were bulged, fire doors blown from their tracks, and all windows broken.

One hundred and twenty-five men were in the plant at the time. All but seven escaped. They were trapped in a basement and probably drowned when

*For a record of gas holder fires and explosions, see "The Hazard of Gas Holders," in the January 1927 Quarterly (Vol. 20, No. 3, p. 285.).



Buildings were wrecked throughout the district. This building, diagonally opposite the Pittsburgh Clay Pot Co., shows a typical result of the explosion.

water from the holders poured in. Some who escaped describe the sensation as of having dust thrown in the face and at the same time being struck on the head with a club. They then remembered nothing until they found themselves safe outside, and could not recall how they got out of the wreckage.

The sprinkler tank fifty feet away remained standing, apparently because the inertia of the mass of water resisted the explosion force suddenly applied and of short duration. This is impressive evidence of the stability of these important fire protection units. The 85-foot trestle appears undamaged, though the riser was broken and the conical roof blown off. A 20-foot piece of steel from the holder was driven through the tank shell by the force of the explosion.

Sprinkler piping was broken in the demolished buildings and under the wrecked roofs of other buildings. Controlling valves had to be closed and the plant was left without fire protection. Meanwhile the fire department laid hose from street hydrants, to be in constant readiness should fire break out in the ruins. The work of rescue came first, but as soon as possible the broken pipes were plugged so that water could be turned into the sprinklers on the lower floors in case of fire. Water could not be left on these systems for fear of freezing, because the buildings were windowless and the boilers wrecked. Three weeks passed before all windows were replaced, boilers rebuilt, and heat was again available so that sprinkler protection could be restored. Meanwhile additional fire buckets were provided and well-instructed extra watchmen patrolled the plant night and day.

The favorable experience of many years shows that gas holders are not a serious hazard. This recent disaster, however, demonstrates what can occur and emphasizes the vital necessity of carrying out the already well-recognized safeguards. The forcible but very expensive lessons of this explosion should give greater safety in the future by forcing an even better realization of the need of proper care and maintenance.

1927 Fire Losses $320,595,600

In United States and Canada.

Fire losses in the United States and Canada last year amounted to $320,595,600 according to figures compiled by the New York *Journal of Commerce* from their daily fire loss records. This is lower than last year's loss by nearly $73,000,000, and is the lowest loss reported from this source in any year since 1919. Following the precedent of previous years, the heaviest monthly losses are registered for the winter months of 1927. The first four months of the year, while showing higher losses than the summer months, indicate a material reduction over the average of previous years and show the downward trend forecast by the experience of the fall months of 1926. During the seven months period, May to November, 1927, the monthly losses were consistently lower by several million dollars than the average figures recorded for these months during the past three years.

Following is a tabulation of the fire losses by months for the years 1924 to 1927, inclusive.

	1924	1925	1926	1927
January	$41,243,600	$41,210,400	$41,118,750	$37,910,600
February	31,447,900	32,472,000	30,963,750	26,285,000
March	28,406,150	33,346,500	42,854,600	26,807,600
April	31,815,900	37,696,800	52,408,400	39,720,600
May	27,832,300	29,170,800	32,764,200	20,713,000
June	20,350,400	23,650,800	28,676,000	25,481,200
July	23,968,860	29,622,000	31,723,400	24,248,600
August	31,349,000	23,348,750	27,833,400	24,299,800
September	29,612,400	25,396,250	19,309,000	21,875,000
October	27,944,400	23,991,250	14,877,000	22,326,600
November	39,081,600	30,320,000	26,724,400	18,992,200
December	44,476,800	43,275,000	43,757,600	31,935,400
Totals	$377,529,250	$373,500,550	$393,010,500	$320,595,600

$9,960,204,845 Since 1879.

Fire record statistics year by year still show an appalling economic waste. The fire losses of the past forty-nine as compiled from the *Journal of Commerce* records reach the vast sum of $9,960,204,845. The following table of

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The fire loss figures of the *N. Y. Journal of Commerce* are based on estimates of fires involving loss of $10,000 or over, with a percentage added to cover small and unreported losses. These figures are not so accurate as, and are usually about a third smaller than, the statistics computed by the Actuarial Bureau of the National Board of Fire Underwriters which, because of the delays incident to compilation of complete records, are not published until later in the year. (The 1926 losses were given in the July, 1927, QUARTERLY, page 18.) The *Journal of Commerce* figures are immediately available, and valuable for purposes of comparison.—ED.

the fire losses since 1879 gives some idea of the extent to which the resources of the country are wasted in fires we know to be largely preventable:

1927	$320,595,600	1911	234,337,250	1895	129,835,700
1926	393,010,500	1910	234,470,650	1894	128,246,400
1925	373,500,550	1909	203,649,000	1893	156,445,875
1924	377,529,250	1908	238,562,250	1892	151,516,000
1923	389,192,200	1907	215,071,250	1891	143,764,000
1922	410,889,350	1906	459,710,000	1890	108,803,700
1921	332,654,950	1905	175,193,800	1889	123,046,800
1920	330,856,625	1904	252,554,050	1888	110,885,600
1919	269,000,775	1903	156,195,700	1887	120,283,000
1918	317,014,385	1902	149,260,850	1886	104,924,700
1917	267,273,140	1901	164,347,450	1885	102,818,700
1916	231,442,995	1900	163,362,250	1884	110,108,600
1915	182,836,200	1899	136,773,200	1883	110,149,000
1914	235,591,350	1898	119,650,500	1882	84,505,000
1913	224,728,350	1897	110,319,650	1881	81,280,000
1912	225,320,900	1896	115,655,500	1880	74,643,400
				1879	77,703,700
Total, 49 years					$9,960,204,845

Large Loss Fires in 1927.

The following list shows twenty-five fires, during the year 1927, where the damage amounted to $1,000,000 or more, according to the estimates of the *Journal of Commerce*.

MONTH	LOCATION	DESCRIPTION	AMOUNT
January	Rochester, N. Y.	Cold Storage Plant	$1,000,000
February	New York, N. Y.	Dress Concern and Others	1,000,000
	Bangor, Maine.	Business Building, etc	1,000,000
	Philadelphia, Pa.	Warehouse	1,000,000
March	Jersey City, N. J.	Railroad Pier, Freight Cars, etc	1,000,000
April	Morgantown, W. Va.	Business Block	2,000,000
	Chicago, Ill.	Army Stores	1,000,000
	Detroit, Mich.	Automobile Body Mfg. Plant	2,500,000
	Douglas, Mich.	Basket Factory, 6 Dwellings, etc	1,000,000
May	Harrisburg, Pa.	State Printing Plant	1,500,000
	Clarks, La.	Lumber Plant	1,000,000
	Hanford, Calif.	40,000 Acres of Grain, 12 Dwellings, etc	2,175,000
June	Montgomery, Ala.	Several Business Blocks	1,500,000
	New York, N. Y.	Warehouse	1,000,000
	Long Beach, Calif.	8 Oil Wells, etc	1,000,000
	Jersey City, N. J.	Armory Building	1,250,000
July	Nederland, Colo.	Tungsten Mill	1,000,000
August	Cleveland, Ohio.	Stadium	1,000,000
October	Oroville, Calif.	Box Factory, Lumber, etc	2,000,000
	Ocean City, N. J.	4 Hotels, etc	2,250,000
	Pittsburgh, Pa.	Several Business Buildings	1,100,000
November	Hopkinsville, Ky.	Business Building	1,000,000
	New York, N. Y.	Automobile Warehouse	2,000,000
December	Kansas City, Kansas.	Cold and Dry Storage Warehouse	1,400,500
	Hoboken, N. J.	Ship and Two Piers, etc	1,000,000

The Paris, London and Berlin Fire Brigades.

By Russell Codman, Jr.
(Member N.F.P.A.)

On a recent trip to Europe the writer had occasion to inspect the fire departments of the cities of Berlin and Paris, having previously inspected the London Fire Brigade. Since customs and traditions differ greatly in these cities, it would hardly be practicable to attempt to analyze these departments on a comparative basis. More information can be obtained by treating each city separately. Bearing in mind the diminutive per capita fire tax in the cities of London, Berlin and Paris, a brief consideration of their fire departments is interesting, especially from the point of view of fire prevention. The writer does not hold up any one of these three departments as superior in any respect to the systems in use on this continent. Rather by taking an objective point of view, the merits in each case may be acknowledged, while any information gained will enable us better to understand our own needs.

Paris.

Scope, Personnel, Equipment.

The fire department provides protection over an area of 31 square miles, serving a population of 3,000,000 people. The city of Paris is divided into 24 sections, each section containing a main and a secondary station. The department comprises 1,855 officers and men, forming the personnel of 29 rescue companies, 32 engine companies, and 29 ladder companies. These are distributed over twelve divisions, two sections to a division.

In certain sections of the city during the day, on a first alarm, the only apparatus sent to the fire consists of a rescue company. This company would correspond to our hose wagon. If the fire develops serious proportions, the ladder company and pumpers are sent on second call. As a rule, however, a first alarm assignment consists of ladder, pump and rescue companies.

Administration.

The administration of the Paris Fire Department is under the control of the War Department, but the city of Paris pays all expenses for its maintenance. The officers are selected from the infantry regiments and enter the department with the rank of second-lieutenant, after having successfully passed a special examination covering requirements both technical and general, in addition to a physical examination. After four months of service each officer is subjected to a final examination, the result of which either confirms his appointment or necessitates his return to his former organization.

The privates are chosen from men who have either had one year of military service, or civilians who are taken under contract because of their

special technical knowledge. In case of retirement, officers and men are in the same category as in any other branch of the army, with the exception that after ten years of service in the Fire Corps they receive additional compensation from the city of Paris.

A supplementary organization corresponding to our Salvage Corps or Protective Department is under the jurisdiction of the Prefect of Police. Divided into companies, each company carries its own equipment designed for the purpose of protecting property from fire and water damage, as well as for fire extinguishment. In addition, searchlight illumination at night fires is provided by this organization acting under orders from the officer in charge at the fire.

Alarm Service.

The fire alarm service is maintained by the postal and telegraph administration of the city. Alarms are sent in either by telephone or by fire alarm boxes located on the public highways, which are distributed over the city at intervals of about 1,300 feet. All fire alarm boxes of every district are attached by special circuit to the main station of their respective districts. The main stations in turn are connected with the central headquarters of the fire department. Thus, an alarm turned in goes first to the main station of its district and is then relayed to the fire headquarters. In case of multiple alarms, headquarters notifies the main station of the district, which will have to send additional apparatus to the scene of the fire. Alarm boxes contain a telephone transmitter, so that the person sending the alarm can describe the nature of the fire to the man on watch in the station house. According to the report received, the officer in charge at the station will send only the apparatus which, in his judgment, would be sufficient to extinguish the fire, and in many cases this system allows a minimum amount of apparatus being sent and has proved to be a great saving to the department.

London.

Scope, Personnel, Equipment.

Greater London, representing an area of approximately 693 square miles, is covered by the City and Metropolitan Police. The administrative County of London, in which the London County Council exercises jurisdiction, covers an area of 117.95 square miles, and it is this district which is covered by the London Fire Brigade. The population of the County of London in 1920 was 4,484,523, as compared with the population of Greater London of 7,489,201. The personnel of the Fire Brigade includes 1,931 officers and men. The Brigade comprises 87 engine companies and 85 escapes (ladder companies), which are distributed over 62 different stations.

Administration.

Unlike the Paris Fire Department, which is a military organization, the London Fire Brigade is a municipal organization similar to that of any American city.

Fire Alarm Service.

The alarm system is similar to that of the Paris Department in that alarms are sent in to the central headquarters for each district and in turn relayed to the general headquarters of the Fire Brigade.

Ambulance Service.

The London ambulance service established in 1915 deals with accidents or cases of sudden illness in streets or public places. Accidents occurring in private houses are also accepted, but the service is not intended for the removal of persons suffering from illness in private houses. The chief officer of the London Fire Brigade is the officer in charge of the service and is responsible for its administration and discipline. The fixed operative staff of the service numbers 123. Nineteen ambulances are distributed over 12 stations. The total mileage of the ambulances for the year 1925 was 169,510 miles. Each ambulance is equipped with oxygen apparatus which in 1925 was used on 278 occasions. Practically all calls are received by telephone, such calls being passed without charge by the telephone service. Needless to say, this department is called upon to perform a great variety of services, even to the extent of providing for the conveyance of urgent maternity cases to the hospitals. During the year 1925 the ambulance department provided transportation for 1,374 maternity cases.

Berlin.

Scope, Personnel, Equipment.

On April 27, 1920, the new city of Berlin was created, adding 87 new communities to the previous city area. The population of Berlin in 1925 was 4,013,588. This metropolitan area covers 338 square miles and is divided into 20 districts. The Fire Department, which covers this entire territory, is divided into five main divisions: Central, Northern, Southern, Eastern, and Western. Each division has its central fire station, controlling a number of sub-stations by direct communication.

The personnel includes 1,838 officers and men in the so-called professional fire department. The city also provides equipment for a volunteer corps of about 2,200 men. There are 36 professional fire stations in the city of Berlin proper and 65 volunteer stations distributed over the suburbs. The department is completely motorized and operates on the two-platoon system.

The Berlin Fire Department also has various other equipment, such as special hose wagons, rescue cars, foam engines, and salvage trucks. It is interesting to note that the ladder trucks are equipped with electric motors for the raising and extension of aerial ladders. The department has recently acquired two ladders with an extension of 100 feet which can be operated by one man. The other ladders have an extension of 86 feet.

Administration.

The former prevailing custom of making the Fire Department subordinate to the Directory of Police has been abolished, and at the present time the

officials of the Fire Department, when retired, receive pensions in accordance with the term of service spent in the Fire Department, to which is added compensation for time spent either in the State or Reich service.

Candidates who wish to obtain the rank of engineer have to submit to physical and mental examinations which are further supplemented by psychological tests. These tests are conducted in a special station where various mechanical devices have been installed which record the various qualifications of the men and show their fitness and suitability for this position.

Since the complete motorization of the fire department, experience has shown that in the city proper a concentration of apparatus has not impaired the efficiency of fire protection, and that buildings which formerly housed separate units could be converted to residential or commercial purposes, which resulted in a reduction of the maintenance cost of the department.

In the high value districts of many cities in the United States and Canada we find a great many station houses containing only a few pieces of apparatus, whereas in the city of Berlin one central station would represent a combination of three or four of our houses. The result is that with the Berlin system each central station is practically self-supporting, because where a large number of men are housed together it is possible to maintain workshops which take care of all the requirements of the fire department pertaining to equipment and maintenance, as well as providing training for various other vocational occupations. Thus we find in most of the Berlin station houses a tailor, cobbler, plumber, carpenter, and mechanics of every description. Practically all the apparatus used by the Berlin Fire Department is constructed in its own workshops, and recently a hose factory was constructed which supplies the entire department with all its fire hose. With the addition of the suburban fire stations, uniform hose couplings and connections were necessary, and by the establishment of this central hose factory the execution of this important measure was made possible and also costs were reduced.

Fire Alarm Service.

With the creation of the new city of Berlin in 1920, through the addition of 87 suburban communities, the former fire alarm system became antiquated, since each suburb had its own separate system, and it became necessary to merge all these various systems into one. At the time when these notes were made adequate appropriations for the installation of a modern fire alarm system had been made and the substitution of this system for the old was progressing rapidly. The signal centrals posted in the fire stations were being fitted out with a new system of 4 to 6 circuits, each circuit controlling from 25 to 30 alarm boxes. In a collective loop are gathered 5 to 6 of such receiving centrals, and the recorded alarms, when checked off, are transferred through this loop to the general headquarters. At all division headquarters alarms are received on three separate systems, a perforating apparatus, which

records on a strip of paper the exact time of transmission and location of the alarm box, a bell system and a light system. A secondary light system records all companies in action at fires until such companies have returned to their respective stations.

The most interesting feature of the fire alarm system in Berlin is the installation of the new fire alarm boxes. The top of the box has two lights: one a fixed red light to show the location of the post at night; and another flashes intermittently when an alarm has been turned in. This flashing light can attract attention at a greater distance than the sound of the bell which is also installed. The person sending an alarm has also telephonic communication with the fire station. The lower half of the box contains equipment for the use of the fire department only, and includes a complete telephone and telegraph system.

Fire Boat Division.

This division includes three boats, two of which are stationed in the West Harbor and one in the East Harbor. The boats have a length of 44 feet, a beam of 10 feet, and a draft of 3 ft. 3 in. They are equipped with 75 horsepower gasoline engines capable of developing a speed of about 12½ miles per hour. All boats have wireless and radio equipment. These boats are each able to deliver approximately 4,000 gallons of water per minute.

The Bureau of Fire Prevention.

The Bureau of Fire Prevention of the Berlin Fire Department has been very completely reorganized and is most thorough in its system of inspections. The engineers of this department have received special instruction in building materials and construction, heating and lighting equipment used in industrial and commercial plants, and are required to pass a very strict examination in the use and storage of various chemicals. The system of inspection is very complete, and the fire department receives active coöperation from the state police, and building departments. The value of this department is best characterized by the statement of the present chief of the fire department to the effect that many fires are being extinguished with pen and ink through the proper observance and enforcement of the preventive regulations.

Conclusions.

The tendency in European cities is to concentrate fire companies in central stations and abolish scattered posts. Experience has shown that apparatus can reach the scene of the fire as quickly and with less congestion of traffic than in American cities, where apparatus is striving to reach the same point from various directions and which results in a general tie-up of traffic as well as increasing the accident risk. Better discipline and a higher morale can be maintained where a large number of men are quartered together, resulting in better provision for accommodations, closer supervision of subordinates upon the part of officers, greater uniformity in the training of personnel, and finally, a reduction in maintenance costs.

Quebec Orphanage Fire.

The Hospice St. Charles in the City of Quebec was visited by fire on the evening of December 14, 1927, with the loss of thirty or more lives. The victims were children, the majority of them being little girls between five and nine years old. The exact number of dead is not definitely known at the time this article is prepared. Thirty corpses have been recovered and identified. A police report made on January 3, 1928, indicated that there were still fifteen children missing.

The Hospice St. Charles was an orphan asylum consisting of a main building built in 1831 and an annex consisting of two adjoining parts built in 1920 and 1925. At the time of the fire there were three hundred and seventy-one children asleep in the various dormitories and about twenty sisters in charge. While this institution is designated as an orphanage, it served also as a school, and the three hundred and seventy-one children included many with living parents whose frantic efforts to find their children added to the confusion and intensified the horror of the catastrophe.

The exterior walls of the building were of stone. The interior was of wooden joisted construction. The central portion was four and one-half stories high and the two wings were three and one-half stories high. With open stairways and open refuse chutes leading from the various floors to the basement, the interior construction of this building favored the rapid spread of fire. There were three wide stairways, and two iron fire escapes were provided on the rear of the building.

Between 8 and 9 P.M. one of the sisters made an inspection of the building and found everything in order, with no indication of smoke or fire. The exact time and point of origin of the fire were not definitely known, but it is clearly established that the fire started in the basement and there is a strong probability that it originated in a room which was used for storage purposes by painters who had been at work in the building prior to the date of the fire.

According to custom all children and the sisters had retired at 9 P.M. About 10:45 one of the sisters was awakened by the crackling sound of burning wood and she immediately rushed to give the alarm, which consisted of ringing the assembly bell. Others were apparently awakened by the smoke about the same time, and the testimony indicates confused shouting and cries of fire throughout the building.

This account is based partly on a report of the Canadian Fire Underwriters' Association (Member N.F.P.A.), and partly on testimony taken at the coroner's inquest and as reported in the Montreal newspapers. The testimony as to the exact happenings during the various stages of the fire is conflicting in some details, but this report is believed to be substantially accurate in essential features.—Ed.

Wide World.

The Hospice St. Charles, a Quebec orphanage, burned on the night of December 14. Thirty or more children were burned to death in this building, despite heroic attempts at rescue. The building, like many others of its class, had substantial exterior walls, but a highly combustible interior. Fire started in the basement and spread rapidly through rubbish chutes and up open stairways.

The sisters marshaled their charges in the several dormitories and started them out of the building. Had it not been for the good discipline which apparently prevailed it is probable that the loss of life would have been much larger. The smoke filled the building rapidly and the corridors and stairways were soon impassable. A large number of those rescued were taken down ladders by the fire department; some jumped or were thrown from the windows and were caught in life nets. It is not clear how many escaped by the different exits, but there is definite testimony that one of the fire escapes was used effectively during the early stages of the fire.

Apparently the greater part of the loss of life occurred in the section of the building directly over the point of origin of the fire. One of the sisters testified that many of the children from five to nine years old who lost their lives had returned to certain death in the dormitories after having been started toward the exits. There is a report that as one group of children marched from their dormitory they were met by a cloud of smoke from which they recoiled and retreated to their beds, shortly to be suffocated there.

The heroine of this fire, Rose Anna Gaudreault, was a young woman of seventeen who lost her life in an attempt to rescue the youngest of the children of whom she had charge. A thrilling story of the heroism of this girl was related by one of the sisters who was working with Miss Gaudreault until the spread of the flames prevented further rescue work. Her account follows:

A couple of minutes after the reverend mother had given the alarm that there was a fire I saw Miss Gaudreault coming down the steps from the third floor leading a group

of six or seven young girls. She was carrying two younger ones. I took them from her and rushed with them to the fire escape at the rear, and upon my return to the second floor to see that all the children were out of my dormitory, I met her again with a similar group of children.

As before, I took them from her, but found the passage to the fire escape cut off. I had to put the children through a window, and firemen on the ground caught them in nets.

Continuing to work with Miss Gaudreault, I again returned to find her again carrying children who had been overcome by the smoke. She was very sick herself, and I told her it was certain death for her to go upstairs again, as the flames were leaping around us as we spoke. As I spoke to her, I felt myself fainting, and I rushed to a nearby window and jumped on the snow.

The nun did not see Miss Gaudreault again. As she ran to the window the sister heard Miss Gaudreault mounting the stairs to go to the children on the third floor. Nearly two hours later the body of the heroic rescuer was found in a corridor on the third floor, near the entrance to a room where several little girls were found dead on their cots.

The Fire Alarm and Response of Fire Department.

The first alarm for this fire was transmitted from a box located in front of the main building. This box was "pulled" by a passer-by at 10:48 P.M. A second alarm was turned in by a policeman at another box at 10:55 P.M., and a general alarm was turned in by a deputy chief of the fire department at 10:56 P.M. The total apparatus responding included the full complement of pumping engines, hose wagons, ladder trucks, etc., with a total of one hundred and ten men on duty at the fire. This included a number of men from the off shift. A total of 10,150 feet of hose was used, representing twelve hose streams. On arrival of the first section of the brigade, heavy smoke was found issuing from the basement windows, also flames from the roof on the southwest side of the building. Two lines of hose were immediately laid from hydrants about 250 feet distant and carried through the yard at the rear of the building to the basement. Water is stated to have been turned on without delay, but the use of the streams was abandoned at the outset, firemen turning their entire attention to the work of rescuing the many children reported to be confined in the building and who at first were understood to have been safely removed. Men responding to the second alarm also united with those already engaged in rescue work. Nine or ten 30- and 35-ft. ladders were unshipped from trucks by this detachment and thrown over the high iron fencing surrounding the building grounds. This unusual procedure was due to the fact that trees and heavy accumulation of snow prevented trucks from being readily driven into the grounds, and was the cause of considerable delay in erecting ladders against the building. Two aerial trucks, for use on the central or higher portion of the building, subsequently entered the grounds through the main gateway but were only suitably placed after some trees had been cut down. About the time the general alarm was transmitted

(10:56 P.M.) two lines of hose were laid directly from a hydrant located in the grounds opposite the main entrance of the building. These lines were carried up ladders and water directed through windows on the upper floor. Attention was next directed to laying additional lines directly from near-by hydrants and the placing of automotive and steam fire engines. With engine and direct hydrant streams in service, the fire was fought from the street level, roof of the kitchen at rear, taking lines of hose into the second story of the building and up ladders raised for the purpose. A total of 670 feet of ladders was raised. During the course of the fire the temperature was moderate and there was little or no wind.

Verdict of the Coroner's Jury.

Indications are that most of the victims who lost their lives were killed by suffocation rather than by burns, although after the fire it was found that many of the bodies were so badly burned as to make identification difficult. Most of the children died in the building, but two of those rescued alive died later in a hospital. The coroner's jury in its investigation of the disaster returned a verdict of accidental death, but added to its verdict a demand "that more effective supervision be required during the night, and that automatic sprinklers be installed in all buildings of this kind."

A Theatre Disaster in Finland.

By Leo Pesonen,

Secretary, Finnish Fire Protection Association (Member N.F.P.A.).

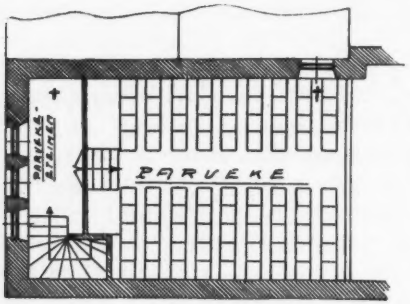
At 19:40 (7:40 P.M.) the 23rd of October, 1927, the film caught fire in the Imatra motion picture theatre in Tammerfors. It has not been found out what caused the ignition of the film. The operator denies that he should have acted carelessly in any way and tells that he noticed smoke suddenly coming from the lower magazine of the machine. Because the act was almost finished, the lower magazine was full of film. Probably the operator opened the magazine, since the whole quantity of film burst into flames. In the projection booth were at the time the films for three programmes and apparently the film box was open, since the whole quantity of film caught fire in an explosion-like way.

The whole theatre was crowded and in the gallery were eighty-seven persons. A panic started, which grew still worse because the lights were out. Nevertheless some of the gallery audience saved themselves by jumping over the rail down to the ground floor. Of these only one perished, as he badly hurt himself in jumping and could not make his way out. The greater part of those who tried to get out through the windows lost their lives. Only three persons jumped from the windows of the gallery hall and of these one died from his injuries. Through the window from the gallery nobody managed to escape; all those who tried this way perished. The total number of lives lost was twenty-one.

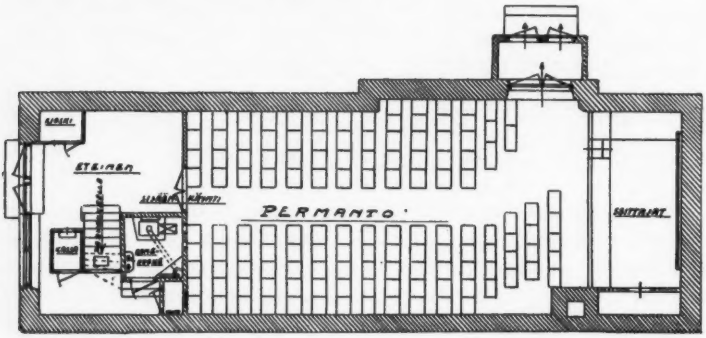
The fire spread rapidly through the entire building, but nevertheless, the people on the ground floor succeeded to escape. In the rush for the exits and in jumping down from the gallery about thirty persons were injured, four of them fatally.

The theatre was the smallest one in the town, with a seating capacity of only 240. The building was originally designed for mercantile purposes, but later, in 1922, was altered into a motion picture theatre. The exterior walls were of brick, but the interior, including the gallery, wooden. The projection booth was made of wood with interior tin covering. The walls and the ceiling of the booth remained, after the fire, practically undamaged. The projection openings were protected through automatic metal shutters which functioned satisfactorily. The glass in the openings was unbroken. True enough, the projection booth was situated in the main entrance hall.

The original drawings, showing the proposed arrangement of the building to accommodate a theatre audience, and approved by the authorities, showed besides the booth door two more doors between the booth and the hall. In



Imatra Theatre.
Diagram of the balcony and ground floor.



reality these doors were omitted and thus, the booth door being left open, the fire in a moment spread up to the gallery.

Even had the theatre been built according to the approved drawings, it would certainly have been dangerous on account of the imprudent placing of the projection booth in the entrance hall underneath the gallery, and on account of the lack of fire escapes from the gallery, which fire escapes easily could have been provided directly to the open air. These deficiencies would not, however, have caused the disaster had not the owners and the local authorities shown great carelessness.

At the inspection made by the fire chief and representatives of the magistrate and the police before the theatre was opened to the public, it was overlooked that: (1) the two additional doors provided for in the drawings and separating the projection booth from the entrance hall were lacking; (2) there was no spring which closed the booth door and the lock bolt did not catch hold without being turned by hand; (3) the ventilating duct from the booth was wooden, and (4) all the electric lighting conduits were drawn through the booth.

The Imatra Motion Picture Theatre, Tammerfors, Finland, where twenty-one lives were lost when film ignited in the projection booth.

No more inspections had been held, so that the owners, who changed frequently, were free to make the following alterations: (1) the door leading from the entrance hall to the parterre and the seats had been changed in such a way that the door was not directly in front of the aisle, but in part blocked by the seats. (2) In the hall had been built a candy booth. (3) Outside the exit door had been built a shelter. (4) The ventilating duct apparently had been plugged or damaged. (5) To the door of the projection booth had been fastened a padlock, which rendered the closing of the door more difficult.

When such dangerous arrangements of permanent nature could be made without the authorities doing anything to stop them, it is not surprising to find that more casual deficiencies were to be found, namely: (1) in the projection booth were kept three times as many films as necessary; (2) as operator worked a ten-year-old boy who was not quite familiar with the handling of the machine; (3) the film box and the magazine were apparently left open; (4) half of the outside exit door was bolted.

The local authorities all blame each other, and because the building and fire ordinances are old, enacted before the existence of any motion picture theatres, they contain no particular paragraph which would clearly cover this case. A proposition for a new fire law, common to the whole country, which law would place the local authorities under supervision of the government, has, since 1920, been circulating between different governmental offices. It is to be hoped that it now will be finished.

The city of Tammerfors, which has a population of 50,000, has a good permanent fire brigade of forty-one men and, as reserve, a volunteer fire

brigade of one hundred and twenty men. It has three automobiles, a motor fire engine and a steam fire engine. The fire brigade arrived at the theatre in less than three minutes and rapidly extinguished the fire with four streams without calling out the reserves.

This disaster proves again the old and well-known fact that the fire department cannot prevent accidents if the preventive fire protection work is paralyzed.

The Ocean City Conflagration

Report by R. M. Cadman.
(Member N.F.P.A.)

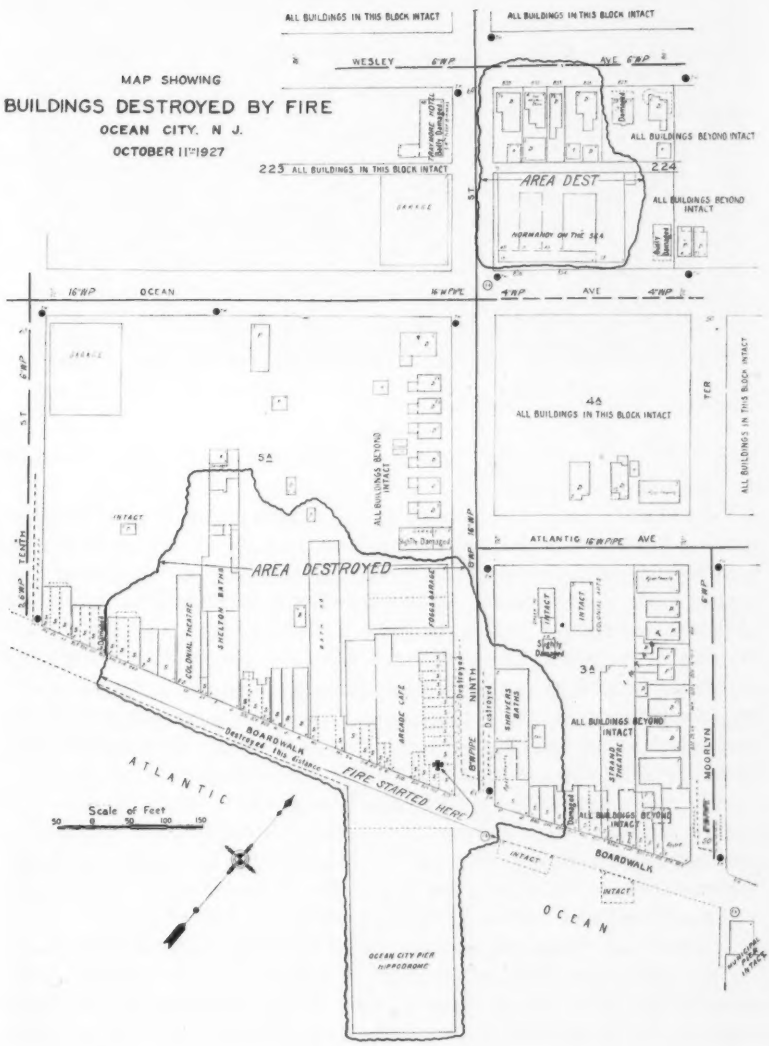
Ocean City, New Jersey, was the scene of a conflagration on October 11, 1927. Ocean City is a seashore resort, located about ten miles southwest of Atlantic City, with an area of about 3.6 square miles. It has had a considerable vogue as a seaside resort, having been founded originally as a Methodist colony. The estimated permanent population is 7,000 and the summer population 85,000.

Virtually the entire section of Ocean City occupied by the summer population or devoted to its interests is of frame construction, with a large proportion of wooden shingle roofs. The stores were closed for the winter and the electric current turned off. It is supposed that a careless smoker threw a cigarette butt on the boardwalk and the wind blew it underneath a building, where it came into contact with some combustible material.

The fire actually started underneath one of the stores at the southwest corner of Ninth Street and the Boardwalk, as shown in the diagram. A fireman who happened to be in the vicinity saw smoke issuing from a point near the Boardwalk and turned in the alarm at 7:09 P.M. from a box located at Ninth Street and the Boardwalk.

The chief's car, three pumpers, one chemical engine and one aerial truck responded and a second alarm was immediately turned in, bringing a steamer, a chemical engine and a high pressure wagon. Before the drive of a strong wind from the ocean the fire spread one block north and south and five avenues westward.

Aid was summoned from near-by cities and towns, including Atlantic City, Camden, and Philadelphia, seventeen pumping engines, four chemical engines, two aerial trucks and one city service truck answering the call and remaining until after midnight when the fire was under control. Due to the strong southeast wind, flying embers ignited wooden shingle roofs throughout


MAP SHOWING
BUILDINGS DESTROYED BY FIRE
OCEAN CITY, N. J.
OCTOBER 11TH 1927
ALL BUILDINGS IN THIS BLOCK INTACT
WESLEY 6WP
AVE 6WP
ALL BUILDINGS BEYOND INTACT
224
AREA DEST
NORMANDY ON THE SEA
223 ALL BUILDINGS IN THIS BLOCK INTACT
16WP OCEAN
16W PIPE
4WP AVE 4WP
6WP
5T
TENTH
5A
INTACT
ALL BUILDINGS BEYOND INTACT
AREA DESTROYED
COLONIAL THEATRE
SHELTON BATHS
ARCADE CAFE
Destroyed
NINTH
Slightly Damaged
46
ALL BUILDINGS IN THIS BLOCK INTACT
TER
ATLANTIC 16W PIPE AVE
3A
SCHREVES BATHS
STRAND THEATRE
MOORLYN
BOARDWALK
Destroyed This Entrance
FIRE STARTED HERE
ATLANTIC
Scale of Feet
50 0 50 100 150
OCEAN
OCEAN CITY PIER
HIPPODROME

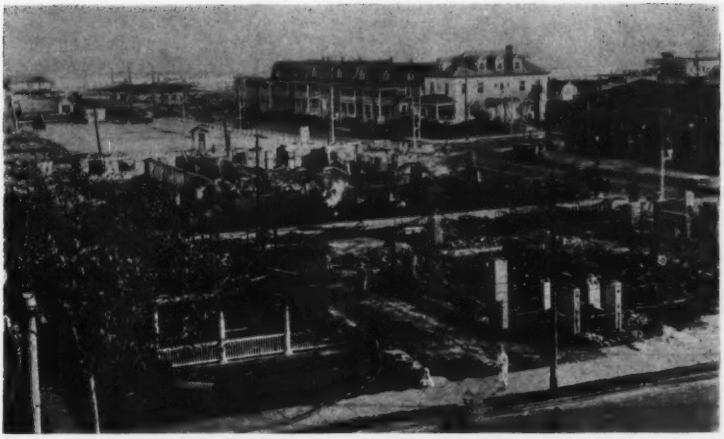
Looking west from the approximate point of origin of the Ocean City conflagration, Ninth Street and Boardwalk.

the entire width of the city, some being carried as far as Somers Point, a distance of two and a half miles.

Hundreds of small fires from flying embers were extinguished by chemical streams, buckets of water and garden hose streams. Citizens over a wide expanse were watching the sparks from the burning buildings sail through the air and alight on their roofs. Garden hose was attached to faucets in scores of houses and sprayed on the shingle and clapboard walls. This wholesale draining of the water supply does not seem to have handicapped the fire department according to the recording pressure gauge chart, for the lowest pressure indicated during the progress of the fire was twenty pounds per square inch at the nearest pumping station. Fortunately the water distribution system had recently been reinforced by the addition of larger mains.

It is estimated that 15,000 feet of hose was laid, 1,250,000 gallons of water were used, and 350 firemen were engaged in fighting the fire. Before an hour had passed the volunteer fire fighters were augmented by all the resources of the area. The Coast Guard station near by, the Beach Guard and the State Police helped to organize citizens as volunteer firemen.

The fire, starting at Ninth Street and the Boardwalk, spread through the entire front of the block, destroying the Arcade Cafe and several stores, demolishing the boardwalk for a distance of five hundred feet. It leaped Ninth Street and burned Shriver's Baths and other properties between Ninth and Tenth Streets. Then it started backward into the wind and the Hippodrome on the ocean side of the Boardwalk caught fire. Before the firemen could stop the flames they had destroyed the pier, and meanwhile the wind



Looking south from Wesley Ave. The buildings whose ruins appear in the foreground were ignited by sparks carried over the row of houses in the middle background.

was carrying the blazing embers westward. In their course lay a garage on Ninth Street opposite Atlantic Avenue. This building was covered with asbestos shingles which withstood the flames and saved the row of dwellings between Ninth Street and Ocean Avenue. But the sparks flew high and houses farther down Ninth Street soon caught fire. The Normandie Hotel on Ocean Avenue at the corner of Ninth Street, a 300-room frame structure, next caught fire and was destroyed. At this point the fire was halted and did not extend beyond this block.

Practically all the buildings destroyed, consisting of stores, dwellings, hotels, garages, theatres and amusement places, were of frame construction. They furnished ready fuel for the fire and burned rapidly. Thirty buildings were destroyed. Among them were three big frame hotels, numbers of shops and business houses, a garage, two theatres, many Boardwalk concessions and Hippodrome Pier, the largest in the city. The loss has been variously estimated as high as $3,000,000, but the most authoritative figures available place it at $810,925.

Loss of Life.

A fire of this character might have involved considerable loss of life were it not that the resort city had shrunk from its summer population to its permanent population of 7,000. Most of the cottages, hotels and boarding houses had been vacated for the winter. Only one hotel, the Strand, was still open, and its occupants were able to escape without injury, taking most of their belongings with them. Three volunteer firemen were injured, and one

The Hotel Normandie during the Ocean City conflagration the night of October 11. The buildings here were ignited by sparks blown 400 or 500 ft. from the main fire area.

death occurred when an unidentified man was struck by fire apparatus on the way to the scene of the fire.

Conclusion.

This fire furnishes further evidence of the potential fire hazard that exists when a large amount of frame construction with wooden shingle roofs is permitted. It is interesting to note that brick buildings on three sides prevented the flames from extending over a much greater area. Undoubtedly a large part of the property in the vicinity of Wesley Avenue, Ninth Street and Ocean Avenue could have been saved if more fire apparatus had been available in the early stages of the fire. It is to be regretted that one piece of apparatus from a neighboring town broke down and several others did not respond immediately, due to a misunderstanding relative to the code used in calling for aid. The fire chief used good judgment in the placing of apparatus and particularly when he repumped water from a storm sewer, making it do double duty.

As a result of the conflagration the old building code is in process of revision, additional fire apparatus and equipment will probably be purchased, and a permanent concrete boardwalk has been planned.

Cigarettes and Cigars, Fire Hazard Tests.

By P. D. Sale and F. M. Hoffheins,*
U. S. Bureau of Standards.

The purpose of the work reported in part herewith is to develop methods for gauging the fire hazard incident to the use of matches, cigars and cigarettes, and the degree of reduction in hazards obtainable when certain modifications are introduced.

The property loss from fire attributable to matches and smoking is equal to approximately one-sixth of the loss from known causes, exclusive of exposure, according to statistics of the Actuarial Bureau of the National Board of Fire Underwriters. If this cause enters into the unreported loss estimate, the loss from unknown causes and if it is the original cause of exposure fires in the same proportion, the total annual loss in this country from matches and smoking as original fire causes approximates ninety million dollars.

The respective losses caused by discarded cigars and cigarettes and by the matches used in lighting them and for other purposes is difficult to estimate. Some State reports list them separately as causes, but apparently by "smoking" may be meant not only the careless disposition of the cigar, cigarette or pipe coals, but also of the match used in lighting them. Based on averages from three State reports and the District of Columbia, the number of fires listed as caused by "smoking" or "cigars and cigarettes" and by "matches" is approximately the same.

Ignition tests with matches are not at a stage that permits reporting results in detail at this time. Lighted matches dropped on grass pads similar to those used in tests with cigarettes and cigars caused ignitions in most cases with no air currents present. The probability of ignition decreased with the distance thrown, occurring only in a small percentage of the trials with safety matches thrown for distances of six feet or more. Considering, however, the great number of matches used, this small percentage is significant. With parlor matches the decrease in percentage with distance thrown was smaller.

The following text refers to cigars and cigarettes only.

Description of Cigarettes and Cigars.

Table 1 gives descriptive data on the nine brands of cigarettes used in the tests. The burning tests on brands 1 to 6 inclusive, which include most of the popular brands, were all run at the same time, while brands 7, 8 and 9 were run separately, as given in the footnote of the table. Brand 8 is a "Cubeb" berry leaf filled cigarette, the fill being more finely divided than the

*Publication approved by the Director of the Bureau of Standards of the U. S. Department of Commerce.

tobacco of the other brands. It had a 1¼-inch length of rolled paper attached as a hollow tip.

Table 2 contains burning data and other descriptive information on the 11 brands of cigars included in the tests. The length that burned after one lighting varied from 0.45 inch to 0.18 inch, while the cigarettes burned their full length, except for the three brands 7, 8 and 9. In the burning tests no air current was applied on or passed through the cigar or cigarette. Chemical analyses of the tobacco and cigarette papers used in seven brands of cigarettes were made by Dr. W. W. Garner of the U. S. Department of Agriculture. While the tobacco contained from .08 to .18 per cent nitrates, there was no

Table 1. Data on Cigarettes.

Brand	Time to burn full length minutes	Length burned inches	Rate of burning in./min.	Weight grams	Density g./cu. cm.	Tobacco
1	19.2	2.75	.14	1.20	0.27	Blend of Turkish and domestic
2	19.2	2.75	.14	1.11	0.28	Blend of Turkish and domestic
3	21.9	2.75	.13	1.09	0.27	Blend of Turkish and domestic
4	22.5	2.75	.12	1.17	0.28	Blend of Turkish and domestic
5	26.9	2.75	.10	1.18	0.31	Domestic.
6	27.2	2.75	.10	1.16	0.31	Blend of Turkish and domestic
*7	30.2	2.91	.10	1.19	0.30	Domestic.
*8	30.8	2.02	.07	1.15	0.42	Cubeb leaf, 1¼ inch cardboard tip.
*9	33.5	2.64	.08	1.32	0.36	Turkish tobacco, $\frac{7}{16}$ inch cork tip.

Table 2. Data on Cigars.

Brand	Time of burning minutes	Length burned inches	Rate of burning in./min.	Weight grams	g./cu. cm.	Retail price cents each
1	2.82	.41	.15	3.4	.35	1¾
2	3.70	.45	.12	4.6	.27	3⅓
3	3.00	.35	.12	8.6	.32	7½
4	3.65	.40	.11	6.2	.38	10
5	3.65	.35	.10	7.4	.32	5
6	3.75	.38	.10	7.7	.34	5
7	2.30	.18	.08	8.9	.35	5
8	4.62	.38	.08	8.4	.32	7½
9	4.90	.39	.08	5.4	.33	2½
10	5.17	.38	.07	5.4	.40	2½
11	4.62	.32	.07	8.9	.36	7½

*These three brands would not burn continuously, so burning data were obtained by relighting until full length was consumed.

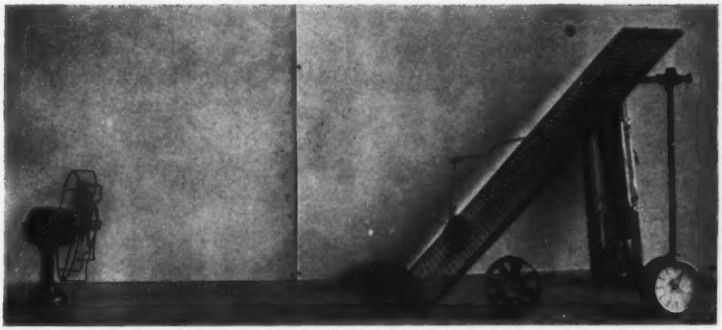


Fig. 1. The test apparatus. Cigarette butt is placed in dried grass pad on wire screen with fan to give wind velocity to promote ignition.

conclusive evidence that this was added in manufacture to improve burning properties, since leaf tobacco normally contains more or less nitrate. The cigarette papers were all free from nitrate, and all but the paper of No. 7 contained 7.8 to 11.7 per cent lime and magnesia filler. The poor burning quality of the cigarettes of brand No. 7 as compared with others made of similar tobacco has been ascribed to this difference in the cigarette paper.

Ignition tests included about equal numbers of each brand of cigar, while those on cigarettes were made mostly with the freely burning brands.

Method of Testing.

After some preliminary experiments in still air with burning cigars and cigarettes placed on different kinds of paper and cloth, crumpled or in layers, that did not give consistent results, a wire mesh container was filled with grass, a lighted cigarette imbedded therein and swung in the air with the result that ignition of the grass was obtained in some of the trials. Accordingly, a dried grass pad was decided upon as the combustible material to be used in the regular tests, and air currents were applied with a small fan.

A daily supply of the dry grass was heated in a laboratory furnace or on the steam radiator each morning and exposed thereafter to the atmosphere in the room. Under these conditions the moisture content of the grass increased with time of exposure. As determined in separate tests, the range in moisture content of the grass pads was apparently within 5 ± 3 per cent in the heated room and 8 ± 4 per cent in the unheated room in the summer. The grass was weighed as required in the individual experiments and stuffed into shallow wire cages 1 inch high, open at top and bottom to give pad densities from 0.032 to 0.099 gram per cubic centimeter.

A fan was selected that gave air currents from 1 to 12 miles per hour by varying its speed and the distance between the fan and grass pad. The air velocity was measured with an anemometer that indicated correctly within

10 per cent in the range 2 to 12 miles per hour. The criterion for ignition in the tests was actual flaming of the grass pad. The "outs" or no ignitions were often preceded by a variable amount of smoke but did not develop into a flame.

The time that the cigarette or cigar butt burned up to ignition was obtained with a stop watch, and the length burned up to time of ignition was estimated by the observer in the cigarette tests and measured in the cigar tests. The test length of cigar varied from the whole length to any portion long enough to be relighted and tested. The test length of cigarettes, untipped and tipped, was 1¼-inch, about a half length of cigarette.

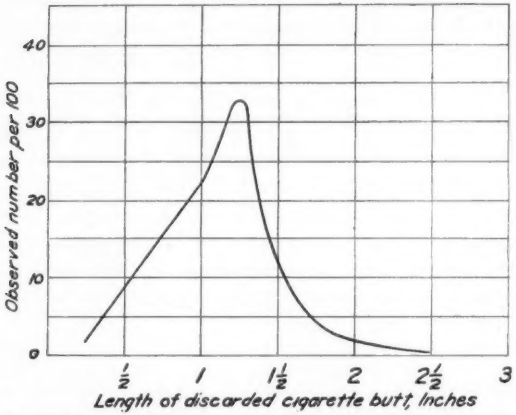


Fig. 2. Frequency of occurrence of cigarette butts of given lengths.

To determine the proper length of cigarette to be used in the experiments, observations were made on the frequency of occurrence of cigarette butts of different lengths, these being estimated to the nearest ⅛ inch. The result from plotting these data is shown in Fig. 2. The curve indicates by its peak that a 1¼-inch cigarette butt is the one most frequently discarded. Two-thirds of the total number observed had lengths between 1 inch and 1½-inch. The observations were made indoors and outdoors, on concrete floors, pavements and on the bare ground, where the thrown butts usually go out without further burning. A half-length of cigarette was lighted in each test and burned for about ⅛ inch, giving the 1¼-inch test length that was then placed on the grass pad.

Results with Untipped Cigarettes and Cigars.

In Table 3 the numbers under per cent ignitions, length and time burned at ignition express average values for the number of tests made for the given grass pad density and range of wind velocity. The tests were very well distributed in the several ranges of wind velocities, as shown by the average

Table 3. Ignition Tests with Untipped Cigarettes on Grass Pads.

Density of grass pad g./cu. cm.	Wind Velocity range: average mi./hr.		Number of tests	Ignitions per cent	Av. Length[1] burned at ignition, inches	Av. time[2] of ignition, min./sec.
.033	1-3	1.9	7	28.6	1.25	9:41
	3-4	3.6	16	43.8	1.04	5:17
	4-5	4.4	25	36.0	1.07	6:02
	5-8	6.5	7	14.3	0.50	4:12
.043	0	0	50	0	[3]1.25	[3]11:17
	1-3	2.0	4	75.0	1.13	7:04
	3-4	3.6	73	94.5	0.93	5:33
	4-5	4.5	15	53.3	0.79	4:22
	5-8	6.4	6	100.	0.94	4:10
.062	1-3	1.7	3	0		
	3-4	3.5	5	80.0	0.88	4:25
	4-5	4.5	13	61.5	0.88	5:31
	5-8	6.2	11	54.5	0.90	3:43
.099	1-3	2.1	3	66.7	1.25	11:53
	3-4	3.9	1	100.0	1.00	4:23
	4-5	4.5	10	70.0	1.00	7:32
	5-8	6.0	2	100.0	1.25	7:08
			Average for all grass pads used.			
.06	0	0	50	0	[3]1.25	[3]11:17
	1-3	1.9	17	41.2	1.20	9:33
	3-4	3.6	95	85.3	0.94	4:47
	4-5	4.5	63	50.8	0.94	5:39
	5-8	6.4	26	57.7	0.94	4:48

[1]Initial length was one-half cigarette length, approximately $1\frac{5}{8}$ inch before lighting for test.

[2]Time of ignition was not obtained on every test, hence the average time was given for the observations that were made.

[3]Values for zero wind velocities are for "outs." No ignition occurred.

Table 4. Ignition Tests with Cigars on Grass Pads.

Average for all grass pads used.

Density of grass pad g./cu. cm.	Wind Velocity range: average mi./hr.		Number of tests	Ignitions per cent	Av. Length[1] burned at ignition, inches	Av. time of ignition, min./sec.
.06	0	0	50	0	[2]0.36	[2]6:53
	1-3	2.4	54	18.5	0.80	4:28
	3-4	3.5	37	8.1	0.58	3:18
	4-5	4.4	63	25.4	0.81	2.59
	5-6	5.4	53	26.4	0.63	2:13
	6-7	6.4	71	35.2	0.69	1:18
	7-8	7.4	60	33.3	0.73	1:24
	8-9	8.5	55	34.5	0.76	1:27
	9-12	10.2	84	39.3	0.85	2:41

[1]Initial length of cigar was variable from ¼ length to full length.

[2]Values for zero wind velocity are for "outs," no ignitions occurring.

values given, which are nearly the mean values of the limits in most instances. The results on untipped cigarettes and cigars show by the ignitions obtained under the variable test conditions that some grass pad densities and wind velocities favor ignitions more than others. General average results, disregarding the effects of grass pad densities, are given in the lower section of this table for each range of wind velocity. These data are plotted in Fig. 3. It should be mentioned that the percentage of ignition increases in general with increase of pad density up to certain limits. In particular, 73 tests at 0.043 gms. per cu. cm. pad density, 3.6 miles per hour wind velocity, gave 94.5 per cent ignitions, these test conditions being adopted later for tests with tipped cigarettes.

Table 4 gives similar data from the cigar tests, the percentage ignitions being in general lower than for cigarettes. The figures in Table 4 are also shown in Fig. 3.

In Fig. 3 the general average values are plotted against wind velocity, the solid curves being drawn to represent the trend of the cigarette data, and dashed lines the cigar data. In the top section of the figure, cigarettes are shown to give ignitions in about 85 per cent of the trials near $3\frac{1}{2}$ miles wind velocity, as against about 20 per cent for cigars. The areas under these curves give a ratio of about 3 to 1 up to about 6.5 miles per hour wind velocity, which indicates the relative hazard from equal numbers of cigarettes and cigars under the same test conditions. This comparison holds for a considerable range of pad densities and wind velocities.

The middle section of the figure shows that the length burned at ignition does not change greatly for a wide range of wind velocities. The length burned is greater for cigarettes, especially at the lower wind velocities. As shown by the lower curves of Fig. 3, the time required to ignite decreases generally with increase in velocity of the air currents applied. With certain combinations of wind velocities and grass pad densities the wind seems to carry the heat away from the burning cigarette or cigar to such extent as to lower the percentage ignitions. The time required to ignite the grass pads appears to vary inversely with the percentage of ignitions obtaining. This indicates that where conditions are favorable for ignition, it will take place in a shorter time than under less favorable conditions.

The reliability of the detail results given in Tables 3 and 4, and in Fig. 3 depends primarily on the number of tests made for a given set of test conditions. Ten tests are considered the minimum number required for good information, and even so are subject to a plus or minus incidental variation of some 20 per cent as it concerns ignitions. A smaller number of tests gives uncertain results, while a larger number up to the 73 tests, cited previously for cigarettes with a given average wind velocity and pad density, more nearly fixes the probability of ignition and the correctness of related information.

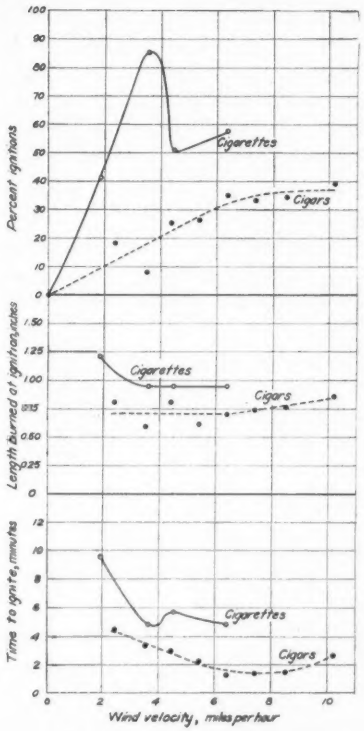


Fig. 3. Effect of wind velocity.

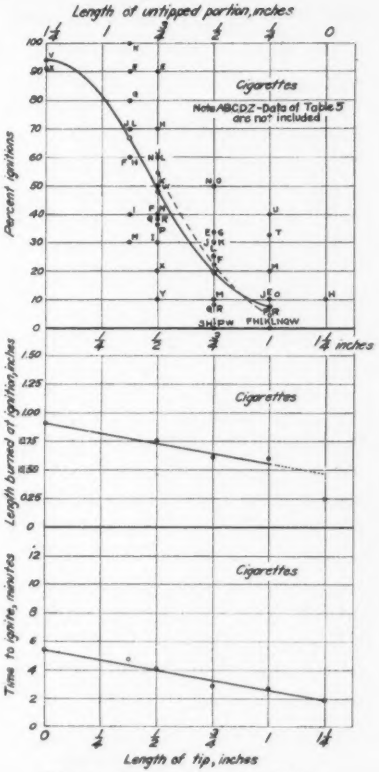


Fig. 4. Effect of length of tip.

The variations in the moisture content of the pads and the humidity of the air undoubtedly affected the results of tests where the differences in these test conditions were large. Each average value is derived from tests conducted under a range in such test conditions which would tend to place them more nearly on a comparable basis.

Results with Tipped Cigarettes.

Results of the tests just described gave sufficient information for selection of the test conditions that could be expected to give 90 to 100 per cent ignitions, using a $1\frac{1}{4}$-inch test length of plain cigarette.

Table 5 shows the various types of tips and treatments tested. The results appear in Fig. 4. Each kind of tip carries a capital letter which serves as a reference in Fig. 4 and in the discussions that follow.

The asbestos paper was 0.003 inch thick and consisted wholly of asbestos fiber. The cigarette paper was 0.001 inch thick and of French manufacture.

The thin cork was 0.003 inch thick, mounted on cigarette paper 0.001 inch thick. The heavy unmounted cork was .008 inch thick, and the medium finish writing paper used as tipping material in a few tests was .0025 inch thick. The "Cubeb" cigarette had a 1¼-inch hollow tip consisting of three layers of .005 inch thick ledger paper. This was tested in its original condition, with the tip plus ¾-inch of cigarette filled with "Cubeb," also 1¼-inch of untipped length (X), and also with the "Cubeb" fill replaced by tobacco (Y). Cigarettes of brand No. 7 were tested untipped in the original condition, and also with ½-inch cork tips (Z).

Sheets of the tipping material were cut to the required widths and applied as tips, coated or just sealed with the solutions described under treatments in Table 5. The cigarettes to which the tips were applied were factory

Table 5. Tipped Cigarettes.
(See Fig. 4 for results.)

Kind of Tip		*Treatment*
Asbestos Paper	A	One layer sealed with saliva.
	B	Two layers sealed with saliva.
	C	Three layers sealed with saliva.
	D	One laver sealed with 1.39 sp. gr. water glass.
Added Cigarette Paper	E	Coated with saturated borax sol., sealed with dextrin paste.
	F	Coated with boric acid—borax sol., sealed with dextrin paste.
	G	Coated with 1:3 water glass.
Thin Cork on Thin Paper	H	Uncoated, plain tip, sealed with 1.39 sp. gr. water glass.
	I	Coated and sealed with 1:4 water glass.
	J	Coated and sealed with 1:3 water glass.
	K	Coated and sealed with 1:2 water glass.
	L	Coated and sealed with 1:1 water glass.
	M	Coated with saturated borax sol., sealed with 1.39 sp. gr. water glass.
	N	Commercially cork tipped, seal not known.
	O	Uncoated, plain tip, sealed with starch paste.
Heavier Cork not on Paper	P	Uncoated, plain tip, sealed with 1.39 sp. gr. water glass.
	Q	Coated and sealed with 1:4 water glass.
	R	Coated and sealed with 1:3 water glass.
No tip Cigarette coated on outside	S	Coated and sealed with 1.39 sp. gr. water glass.
	T	Coated and sealed with 1:4 water glass.
	U	Coated and sealed with saturated borax sol.
No tip	V	No treatment (Brands 1-6 incl. and 9).
Miscellaneous	W	Medium finish tablet writing paper, sealed with 1.39 sp. gr. water glass.
	X	Commercial medicated Cubeb cigarette.
	Y	Commercial medicated Cubeb cigarette with Cubeb filling replaced with tobacco.
	Z	Commercial, low hazard cigarette, one-half inch tips heavy cork, sealed with 1.39 sp. gr. water glass.

made and of brands previously tested untipped, those of brands 1, 3 and 5 (Table 1) being used more frequently than the others.

The average (solid) curve in Fig. 4 shows that per cent ignitions, length and time burned at ignition, decrease with increase in length of tip, or vice versa, with decrease in length of untipped portion. The total test length was $1\frac{1}{4}$ inches and the percentage ignition for untipped cigarettes under the test conditions for tipped cigarettes (.043 pad density, 3.7 m.p.h. wind velocity) had been shown to be between 90 and 100 per cent, as indicated by the plotted points for V and X treatments. The ignition hazard is reduced on the average to 50 per cent by use of $\frac{1}{2}$-inch tips, to 20 per cent by use of $\frac{3}{4}$-inch tips, and to less than 10 per cent by the use of one-inch tips. The "V" data show that on the average 0.91 inch of the cigarette is burned when ignitions occur in 95 per cent of the trials. Even the $\frac{3}{8}$-inch tip that leaves a 0.88 inch untipped portion reduced the ignitions to 67 per cent.

The A, B, C and D treatments with asbestos paper tips proved relatively ineffective in these tests. The single or double layer tips became heated to glowing by the cigarette fire, which progressed in the filler and cigarette paper for the full length of the tip. With the 3-layer tip the insulation was sufficient to materially reduce ignitions.

For tips of combustible materials the glow in the cigarette progressed generally not more than $\frac{1}{8}$ inch into the tipped portion. The coated tips, such as I, Q and R, generally gave lower percentage ignitions than the average for all groups. The average for the uncoated cork and plain paper tips, H, N, O, P and W is shown by the dashed line in the upper diagram of Fig. 4 to come near the average curve. The tips H and P, sealed with water glass, were, however, more effective than the others, also the heavy cork gave in general lower percentage ignitions than tips of the thinner material.

Summary.

The object of the testing procedure developed was primarily to obtain comparative results with plain cigarettes and the same tipped or otherwise modified to reduce the fire hazard from discarded butts. It cannot be considered as being representative of all conditions under which fires are caused by cigars and cigarettes. The results indicate, however, that conditions favorable for ignition are required in order that the glow of the discarded butt may cause flaming in ordinary combustible materials. Of 50 tests, each made with lighted cigars and cigarettes on grass pads and no air currents applied, no ignition took place. This should not be considered as exhausting the possibilities in this respect even for the given test conditions. When it is considered that on the average some 170,000 cigarettes are discarded for each minute of the 24 hours, it is easily seen that even if conditions favorable for fire origin are present in only a few of the cases, they will account for all of the fires that are attributed to this cause. With air currents of proper in-

tensity applied, ignitions were consistently obtained in over 90 per cent of the trials with plain cigarettes on dry grass pads, and in from 10 to 40 per cent of the trials with cigars.

Tipping the cigarettes is effective in that the glow in the discarded butt is extinguished soon after it enters the tip, except for the thinner asbestos paper tips. Tips coated with fire-retardant solutions are apparently a little more effective than uncoated tips, although heavy cork tips $\frac{3}{4}$ to 1 inch long sealed with water glass gave percentage ignitions below 10 per cent.

As to the relative hazard of cigars and cigarettes, the cigarette consumption is now near 90 billions per year and that for cigars seven billions. Since the percentage ignitions with cigars was approximately one-third of that with cigarettes, the relative potential hazard as fire causes would be in the approximate ratio of 1 to 40.

Relative to matches as a fire hazard and possibility of its reduction, less quantitative relative information can be given. Nearly 300 billion matches are used annually in this country, a considerable portion of which are used in connection with smoking. A lighted match dropped on readily combustible materials will cause ignition in a large percentage of the cases. The percentage ignitions decreases with the distance the match is thrown, but even for the longer distances thrown the percentage remains large enough to be responsible for very many fires, considering the large number used.

The only safe precaution with matches, as, in fact, with cigars and cigarettes, is to be certain that the flame or glow is extinguished before they can come in contact with combustible materials.

The Hotel Commodore Fire

Report by New York Board of Fire Underwriters.
(Member N.F.P.A.)

That a fire of serious proportions can occur in a modern fire-resistive building which is under generally good supervision was demonstrated again by the fire of November 2, 1927, which damaged a portion of an upper floor of the Hotel Commodore in New York City to the extent of between $27,000 and $30,000.

This hotel building was erected in 1916-1919 and covers an area of 57,200 square feet and reaches a height of twenty-six stories, with a roof structure extending three stories higher. It is of modern fire-resistive construction and is under the best of supervision.

The lower floors are used for boiler and engine rooms, general hotel purposes and stores; the sixth to the twenty-sixth floors are occupied as guests' rooms. The roof structure is used by a valet shop, telephone exchange, tank room, elevator machinery room, mason's room, etc.

Origin of the Fire.

A bank of ten elevators terminates at the first floor of the roof structure and opens into a corridor approximately 100 feet long, 10 feet high and 10 feet wide. One of the elevator cars located near the center of the group was being renovated and two painters were engaged in the work of refinishing its interior. The car had been run to the top of the shaft and the work of removing the old finish started. The small fan in the car was removed and the ends of the electric wires taped. The inside of the car was then coated with a flammable and volatile varnish remover applied by hand brush from two ordinary size (about a quart) tomato cans; the supply being replenished as required from a one-gallon can of the same material which was kept near or inside the car.

The work had progressed to the point where practically all of the interior of the car had been coated with the varnish remover and steel wool was being used to take off the old finish. One of the painters was using the steel wool in close proximity to the electrical fan receptacle when a flash occurred and almost instantly the entire car was ablaze. The painters were able to escape from the car but did not close the elevator doors and the fire extended into the elevator corridor. These men with other hotel help endeavored to extinguish the fire with a 2½-gallon chemical extinguisher and by hand hose from the building standpipe system, but were unable to cope with it.

After several minutes had elapsed a watchman pulled an N. D. T. alarm box located on the 25th floor. This alarm is reported to have been received

at the central station of the N. D. T. Co. at 3:59 A.M., but the alarm through an error was not transmitted to Fire Headquarters. The alarm is said to have been sent by telephone message from the hotel at 4:04 A.M., and Fire Headquarters sent out a signal at 4:05 A.M. The operator in the central station of the N. D. T. Co. did not discover his error until 4:07 A.M. and did not transmit the alarm to Fire Headquarters. The cause of this is not yet known.

The elevator corridor is enclosed by 4-in. hollow tile, the west end leading to the roof of the main building. The east end was protected from the rest of the floor by metal covered self-closing swinging doors. Adjoining the corridor and separated from it by the 4-in. tile partition on the south side, is the hotel valet shop. Two door openings, protected by flat framed iron doors, lead from the valet shop to the corridor, and there are also three small vent openings in the partitioning near the ceiling.

Located inside the corridor were several steel lockers which contained employees' clothing, a large frame cabinet containing employees' and guests' clothing, and on the floor at the west end of the corridor were several rolled up rugs. Some house pipes passed through the corridor near the ceiling, in part protected by insulating covering.

A 6-in. uncovered standpipe connection from the tanks on the second floor of the roof structure passed through the ceiling of the corridor at a point almost directly in front of the car in which the fire originated. From here it extended in a horizontal direction about two feet below the ceiling of the corridor, a distance of 60 ft., to the southwest corner of the corridor, at which point it extended down through the corridor floor to the balance of the system below.

During the fire the hotel fire pump was operated and apparently worked satisfactorily. Upon the arrival of the fire department the blaze had abated considerably. However, connection was made to the standpipe system through a street siamese connection and the fire was finally extinguished by hose streams from the standpipe. It was then discovered that an elbow in the 6-in. standpipe connection had cracked and the water from the two supply tanks was being discharged into the corridor. An attempt was made to shut off the water, but the gate valve to one tank did not operate properly and could not be completely closed and considerable water continued to flow into the corridor.

The cause of the standpipe rupture can possibly be attributed to either of two causes. The pipe itself had moved upward a distance of approximately two inches and it is quite possible that the movement of the pipe, which really was the cause of the elbow cracking, was due to the pressure placed upon the system through the fire department connection. It is said that sufficient pressure existed to burst a length of hose on the 26th floor.

It is also quite possible that when the standpipe was originally installed the length of pipe that passed through the floor was cut too long, with the

result that a strain always existed at the elbow. A hanger supporting the pipe may have been subjected to enough heat so that it no longer retained any stiffness and allowed the pipe to spring upward. While the standpipe line was not protected by insulation, it is improbable that the heat upon it could have caused any material expansion of the pipe.

Extent of Damage.

The elevator car in which the fire originated was so badly damaged that it will probably have to be replaced, as well as the doors to at least six of the other elevators. The cabinet, lockers, their contents and other combustibles in the elevator corridor were practically destroyed. The corridor will have to be almost completely replastered and redecorated, new doors provided at the west end of the corridor and at the entrances to the valet shop. Some smoke extended into the valet shop but fortunately there was no damage of any amount there. The elevator machinery is located at the top of the shaft, but is so separated from the shaft by a concrete slab that it was not damaged. The slab was probably instrumental in causing the fire to extend into the corridor so readily. Portions of the ceilings in a large number of guests' rooms and in the hallway on the floor below the fire were damaged by water, which went down through the hole broken around the standpipe when this pipe moved upward. The water apparently traveled along piping, as ceilings were damaged at points very remote from the vicinity of the fire.

Conclusions.

This fire demonstrates the possibilities of the unusual and unexpected things that may happen in even the best constructed, protected and supervised buildings. To start with, there was the manifest foolish act of the workmen using steel wool to allow it to come in contact with live electrical equipment, augmented by the use of a volatile paint remover which tended to a flash fire. Then in the excitement the workmen did not close the doors of the elevator car and the fire spread to the corridor. After a while someone thought of transmitting a fire alarm. The operator in the private central station failed to recognize the alarm or transmit it to fire headquarters. The telephone was then used and after some further delay an actual alarm of fire was sent out.

When the operations of the fire department were completed, so far as the use of the standpipe equipment was concerned, it was found that the standpipe had ruptured from a cause that is at best surmised. Then it was found that a gate valve, which is placed at a certain point to perform a certain function, could not be operated, resulting in a quantity of water from the gravity tank finding its way into the building through the ruptured standpipe and doing a large amount of damage to the property which otherwise might have been avoided. That someone did not know that the gate valve at the gravity tank supplying the standpipe system was not in proper operating condition, emphasizes the necessity for proper supervision and testing of standpipe equipments.

Church Fires

Divine Providence, rather than proper construction, protection and control of hazards, would appear to be the principal reliance for the fire-safety of churches, judging by conditions shown by the reports of one hundred and fifty-four fires in churches on file with the N.F.P.A. Department of Fire Record. The reports on which this record is based are those of fires since January 1, 1920, and while the number of fires reported to the N.F.P.A. is but a small fraction of the total number that have occurred during this period, the volume of data is sufficient to draw general conclusions as to the predominating causes of church fires, the method of their spread, the effectiveness of protection and like details.

No major holocausts have as yet occurred in American or Canadian churches to direct public attention to the construction and protection of this class of property, which has not received the consideration accorded to theatres and schools, occupancies having many similar characteristics. Churches, because of the character of their occupancy, with a minimum of the usual hazards attendant upon residence, commercial, and special hazard occupancies, would appear to present relatively few opportunities for the start of fire. This is apparently offset, however, by inferior construction, defective heating and lighting installations, lack of lightning protection for steeples particularly exposed to this hazard, and a grade of supervision and maintenance frequently not comparable to that found in other types of property. Large values are frequently concentrated in church property and many churches have historical and sentimental associations which greatly surpass the physical values involved and which justify a degree of attention to fire-safety far beyond that which has thus far been generally accorded church property.

The extent of church fires is shown by the figures compiled by the National Board of Fire Underwriters, which indicate that fires occur in churches at the rate of five a day and that the annual loss in churches in the United States alone is nearly $4,000,000. Fire visits the places used for worship by different sects and creeds quite indiscriminately, as is shown by the table on the next page, indicating the distribution of the N.F.P.A. fire reports according to denominations.

The causes of church fires are shown in the following tables, the first prepared from the N.F.P.A. records, and the second compiled from the latest available figures of the National Board of Fire Underwriters. These data, from separate sources, agree as closely as can be expected for two sets of figures compiled on a different basis: one including a relatively small number of fires classified in accordance with number of fires due to each cause, and the

International.

Fire in the famous church of Ste. Anne de Beaupré at Ste. Anne, P. Q., which was destroyed on March 29, 1922, with a loss estimated at over $300,000. The fire was discovered in the sacristy in the rear of the church, from whence it spread, fanned by a strong wind, simultaneously towards the roof of the cathedral on the west side and to the roof of the monastery on the east side. The monastery and college were quickly destroyed, but the fire made slower progress in the church. Villagers did what they could to fight the fire, but were practically powerless until the firemen arrived from Quebec. Lack of water prevented effective work by the firemen and the structure was almost entirely destroyed. The famous statue of Ste. Anne to which are attributed certain miraculous powers was saved. Following this fire a temporary basilica was constructed and this, a few years later, on November 9, 1926, was again destroyed by fire. Although firemen again came from Quebec, they were unable to do much because of the lack of water supply.

other on the basis of money loss and susceptible of distortion by reason of one or two large loss fires due to a relatively infrequent cause.

Denominations Represented in N.F.P.A. Fire Record.

	No. Fires		No. Fires
Roman Catholic	32	Community Churches	2
Baptist	25	Greek Catholic	1
Presbyterian	19	United Brethren	1
Methodist-Episcopal	18	Church of Christ	1
Methodist	14	Universalist	1
Lutheran	9	Latter Day Saints	1
Episcopal	9	United Free Church	1
Congregational	8	Reformed	1
Christian	5	Unitarian	1
Hebrew	2	Unidentified	1
Evangelical	2		154

Cause of Fires in Churches, From N.F.P.A. Fire Record.

	No. Fires
Heating plant	31
Defective chimney	19
Defective wiring (not including organ)	17
Lightning	12
Organ wiring	7
Exposure	6
Sparks from chimney on wooden shingle roof	4
Spontaneous ignition of bituminous coal	2
Candles	2
Gas explosions	2
Miscellaneous known causes	*8
Incendiary	4
Unknown	40
	154

*One fire from each of the following causes: Woodwork around fireplace, explosion of oil stove, fuel oil system, gas stove left burning, rubbish, cleaning cloths, sparks from unknown source on wood roof, painter's blow-torch.

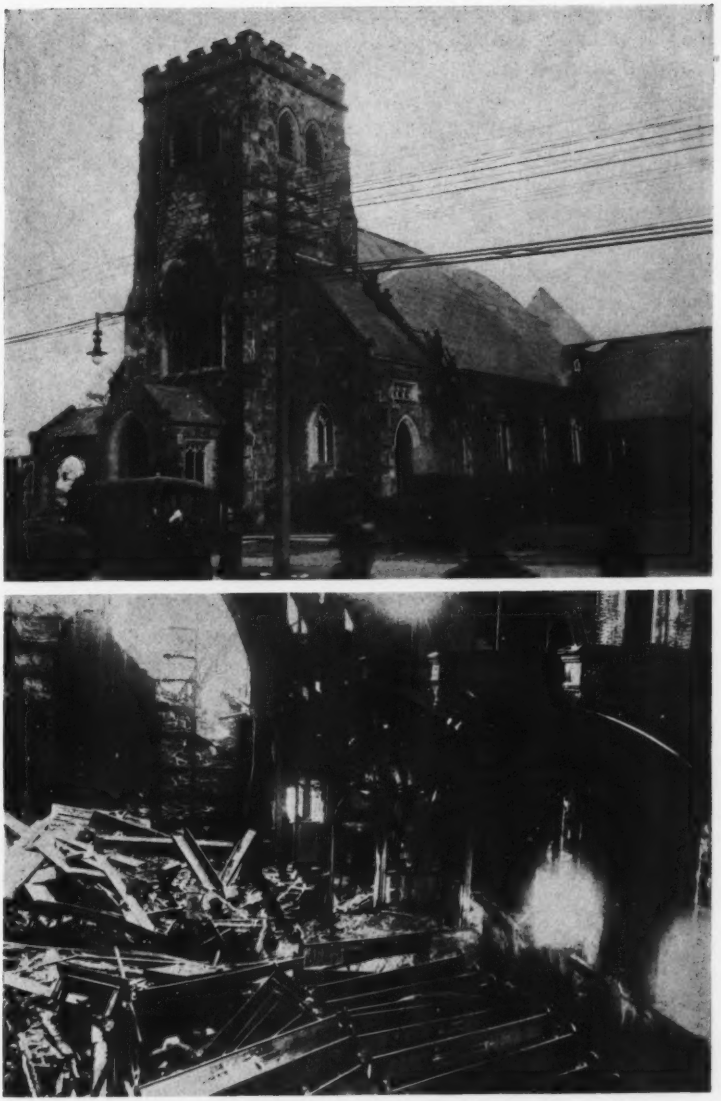
Fire Losses in Churches, 1921-1925.

According to National Board of Fire Underwriters.

Cause of Fire	Loss
Stoves, furnaces, boilers and their pipes	$2,943,607
Lightning	1,747,545
Exposure (including conflagrations)	1,597,529
Defective chimneys and flues	1,061,486
Matches—Smoking	718,667
Electricity	710,649
Sparks on roofs	585,524
Open lights	535,473
Spontaneous ignition	430,076
Gas, natural and artificial	151,246
Miscellaneous known causes	532,793
Unknown	8,223,097
	$19,238,097

It is interesting to note the large number of fires from a relatively small number of different causes. These principal causes are the heating plant, defective chimneys, defective wiring, and lightning. It is not surprising that the fires due to the heating plant in churches should be frequent, because of the conditions under which they are used. An adequate heating plant is not always provided, necessitating forcing the plant for the one or two days of the week in which the church is used. This frequently causes overheating and results in fire.

As in other occupancies, defective chimneys cause a large number of fires, due to the fact that chimneys are seldom inspected or repaired.



International.

The First Baptist Church of Arlington, Mass., was of substantial construction, as appears from the upper picture. Like many similar structures it gave a semblance of fire-safety which did not in fact exist, as the lower picture, taken after the fire of Oct. 24, 1924, shows. On the rear wall may be seen the partly burned wooden sheathing and the concealed spaces which permitted the rapid spread of fire from basement to roof.

"Defective wiring" as a fire cause is always open to question. In a number of fires in this record in which this cause was assigned there is some doubt as to whether or not that was the actual cause. Fires starting in the electric wiring of organs are, however, better authenticated.

Lightning is an important fire cause in churches, the tall spires of many churches being attractive targets for lightning.

It will be noted that there is a large loss due to exposure fires, which is doubtless due to a few large loss fires.

Part of Church in Which Fire Originated.

	No. Fires
Basement, exact location not known	22
Furnace room	16
Auditorium	19
Roof	16
Steeple	12
Organ loft	8
Exposure	6
Attic	5
Community or Parish House	5
Sacristy	2
Miscellaneous known locations*	11
No data	32
	154

*One fire in each of the following locations: Pastor's study, room at rear of pulpit, chapel, Sunday school room, church kitchen, dining room, janitor's room, rest room, closet, vestibule, under stairway.

As is the case in schools and institutions, the basement is the hazardous portion of the building, the furnace room probably being the most frequent point of origin of fire, as it may be assumed that many of the basement fires for which a specific point of origin cannot be assigned should be included in this classification. The table as a whole indicates that a large number of fires start in small rooms and concealed spaces in the building. These fires are difficult to get at and are often responsible for the fire spreading extensively before it can be brought under control.

The amount of loss in church fires is given in the following table.

Analysis of Loss.

	No. Fires
Over $100,000	10
$10,000—$100,000	66
$5,000—$10,000	13
Less than $5,000	7
Large loss, no exact data	41
Small loss, no exact data	3
No data	14
	154

St. Paul's Church, Newburyport, Mass., Apr. 27, 1920. This fire occurred about 3 A.M. and was first noticed on the roof of the main part of the building near a rear addition. The building was of frame construction and the cause of the fire is variously assigned to a spark from a passing locomotive alighting on the church's wooden shingle roof, or to defective electric wiring inside. The fire was fought at the rear of the building near where it started and appeared to be under control when it suddenly broke out at a point in the church tower at the other end of the building, having apparently spread through the open loft of the building. It was finally brought under control, but not until the church had been very severely damaged. This church was a local landmark with many historic associations.

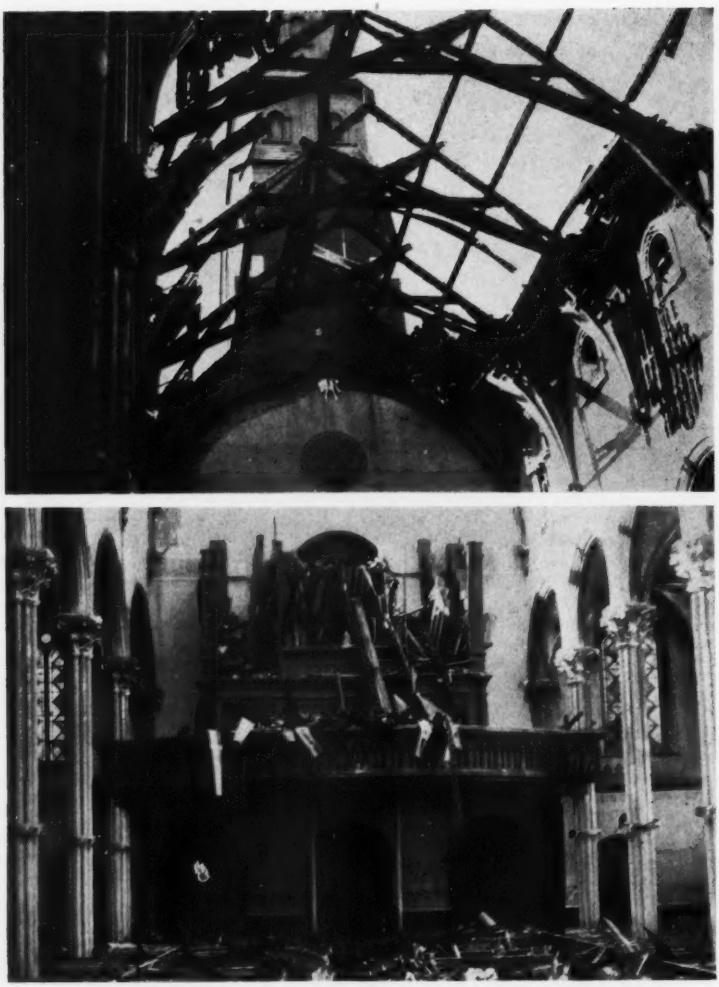
The preceding table shows that large losses are the rule in church fires, and this is undoubtedly due to the construction of these buildings, which are usually of large area, and where the fire quickly gets into the roof or open loft above the auditorium, where it is practically inaccessible to the fire department.

How Fire Was Discovered.

	No. Fires
Outsider	96
Minister	11
Sexton	10
Member of congregation	10
Workman	2
Organist	1
No data	24
	154

Day of Week in Which Fire Occurred.

	No. Fires
Sunday	37
Monday	24
Tuesday	13
Wednesday	22
Thursday	16
Friday	22
Saturday	20
	154



Courtesy Fire Engineering.

Two views of the fire in St. Mary's Church, Bridgeport, Conn., Oct. 21, 1927. Fire started in the furnace room and caused a damage of over $100,000 before it was brought under control. Fire supposedly started in a defective flue and spread from the rear of the church to the front through a blind attic that was more than 15 ft. high. As the upper picture shows, the roof was completely destroyed. The lower view shows how the church organ, which was located in a loft over the entrance of the church, was blown apart by an explosion, either of dust in the organ pipes, or a smoke explosion. The fire department was able to save the walls of the building and its steeple, although the roof and the altar at the entrance of the building were severely damaged.

Courtesy *Fire Engineering.*

Ruggles Street Baptist Church, Boston, Mass., July 21, 1925. Fire spread through this aged wooden structure with great rapidity and showered embers and sparks over a considerable section of the city near by, starting a number of roof fires. The blaze was discovered in the organ loft, presumably due to a defect in the organ wiring. Firemen were called by three alarms and attempted to control the fire, which spread through the loft of the building and had soon demolished the roof. This was the third time this church had been visited by fire. The damage was about $150,000.

That most of the fires should be discovered by outsiders is due to the fact that the churches are in many cases unoccupied during the week. The table of days of the week on which fire occurred shows that Sunday is only slightly more hazardous than the other days of the week.

Construction of Buildings.

	No. Fires
Frame	62
Brick or stone	58
Brick veneer	8
Composite	3
Insufficient data to classify	23
	154

Most of the buildings covered in this record were of wood or with wooden interiors. None were apparently in any sense fire-resistive. Even where the church has substantial masonry walls and even possibly a fire-resistive first

International.

Ruins of St. Constantine's Orthodox Greek Church, Chicago, in which valuable paintings and furnishings were lost. The damage was estimated at $125,000.

floor, it is quite common to provide a wooden roof, which this record shows to be the part most susceptible to major fire damage.

Even where there are masonry walls the studding and plaster finish add fuel to the fire, and make concealed spaces through which fires spread from the basement to the roof.

Available Fire Protection.

	No. Fires
Some water supply	102
Water supply available but inadequate	10
No water supply, but fire department used chemicals	9
No fire protection	10
No data	23
	154

In the majority of the fires there was some sort of water supply available, but the more serious losses occurred for the most part where there was little or no water available for fire fighting. Numerous other bad losses are chargeable to an inadequate fire department not equipped to handle church fires. Many of the fires spread up under the roofs of churches and are inaccessible to ordinary hose streams.

It is significant that none of the one hundred and fifty-four church buildings covered in this record were equipped with automatic sprinklers. Sprinklers would not be recommended for high studded church auditoriums, but

they should be most effective protection for basements and attics, where the majority of church fires originate, particularly so in view of the fact that the great majority of the fires occur when the buildings are unoccupied.

Fires Occurring While Churches Were Occupied.

Of the 154 fires in this record, in only eleven cases were the buildings occupied at the time of the fire. In no case was there any evidence of difficulty in getting the people out of the building. It should be noted, however, that there were no really serious fires among the eleven which occurred while the building was occupied. In six cases the members of the audience were adults, and in three cases the fires occurred with the buildings occupied by children. In two cases men impersonating Santa Claus at Christmas celebrations had their costumes ignited, one by a candle and one by a gas stove. In these cases the fire was confined to the individual's clothing, with serious burns sustained by the person, but without spread of fire to building or contents.

A Partial List of Large Loss Church Fires.

Date		Loss
March 7, 1921	Jackson Ave. Sunday School, New Orleans—4 firemen killed.	
October 21, 1921	First M. E. Church, Brooksville, Pa	$122,000
December, 1921	Church at Drummondville, P. Q	150,000
March 29, 1922	Ste. Anne de Beaupré, Ste Anne, P. Q	200,000
April 3, 1922	Sacred Heart, Montreal, P. Q	400,000
December 22, 1922	Notre Dame, Quebec, P. Q	350,000
December 26, 1922	St. Thomas d'Alfred Lafaivre, Ont	100,000
June 15, 1923	Sully Church, Temiscouata, P. Q	120,000
July 11, 1924	McKeesport Church, McKeesport, Pa	150,000
October 9, 1924	St. Mary's Catholic, Onset, Mass	100,000
November 22, 1924	St. Vincent de Paul, Montreal, P. Q	200,000
January 2, 1925	First Baptist, Woburn, Mass	100,000
April 15, 1925	Holy Trinity Episcopal, New York, N. Y	500,000
July 20, 1925	Ruggles Street Baptist, Boston, Mass	150,000
October 29, 1925	Annunciation, Shenandoah, Pa	150,000
February 6, 1926	Grace Congregational, Framingham, Mass	150,000
March 7, 1926	Emmanuel Baptist, Little Rock, Ark	130,000
August 7, 1926	Cookman M. E., Philadelphia, Pa	200,000
August 14, 1926	Louisville Church, Maskinonge, P. Q	200,000
December 3, 1926	Second Congregational, New London, Conn	150,000
January 16, 1927	First Baptist-Congregational, Wilkes-Barre, Pa	108,000
January 26, 1927	Mormon Chapel, Turner, Idaho—6 persons killed.	
February 5, 1927	First Congregational, Toledo, O.—3 persons killed.	
March 11, 1927	Old Stone Methodist, Meadville, Pa	109,000
May 30, 1927	St. Charles Church, Waltham, Mass	100,000

Note: The number of fires in the Province of Quebec recorded above is due to a very complete list of these furnished through the courtesy of M. Ernest Lavigne, Fire Commissioner of the Province of Quebec, and the Associations d'Assurance Mutuelle des Fabriques des Dioceses de la province Ecclésiastique de Montreal and d'Assurance Mutuelle des Fabriques de Quebec.

Courtesy *Daily Record and Mail.*

This, the Kelvingrove United Free Church of Glasgow, Scotland, was set on fire July 7, 1925, by embers from a fire in a large frame hall more than 500 yards away. The local fire brigade was occupied at the main fire and the wooden interior was largely burned out before apparatus and men could be marshaled to fight the fire in this church. The loss of the church is estimated at $250,000.

Typical Fires in Churches.

Fires Due to the Heating Plant.

TRINITY EPISCOPAL CHURCH, SCOTLAND NECK, N. C., JAN. 6, 1924. This fire occurred on Sunday a few hours after church had been dismissed. The day was very cold and the furnace had been pushed hard to heat the building. The furnace was too near the wooden joists, and being left unattended set fire to the building, which was completely destroyed. (H-20357.)

THE HAMLINE METHODIST EPISCOPAL CHURCH, ST. PAUL, MINN., DEC. 26, 1925. A new fireman had been employed to run the heating boiler, and this man, apparently being unfamiliar with the furnace, allowed it to overheat. The smoke pipe from the heater to the chimney passed too close to wooden joists, which were ignited. A severe fire followed, causing four alarms to be sounded. This large amount of apparatus was necessary because the fire produced flying brands which were being carried over a considerable area. The fact that many of the wooden shingle roofs in the vicinity were partly covered with snow prevented a conflagration. The damage amounted to $74,000. (H-22871.)

COMMUNITY CHURCH, WEBSTER, MD., JAN. 27, 1924. The exact cause of this fire is not known, but it is attributed to an overheated "pipeless" furnace. The people attending a church meeting a week prior to the fire had complained of being cold and it is known that the furnace was being forced in an attempt to keep everyone comfortable. (H-20599.)

SHILO BAPTIST CHURCH, PHILADELPHIA, PA., DEC. 10, 1922. This was a church building of ordinary construction, owned and used by a colored congregation. On opening the church on Sunday morning, the sexton discovered fire in the basement. Although the firemen had difficulty in entering the cellar due to dense smoke, the fire was finally extinguished after the floor supports had been badly charred and some damage was done to the first floor. It is supposed the fire originated from the heater in which a fire had been started the day previous, preparatory to the Sunday morning service. (H-19051.)

Lightning.

PRESBYTERIAN CHURCH, TROY, ILL., AUG. 23, 1926. During a severe electrical storm the church steeple was struck by lightning. The people who first discovered the fire attempted to call the fire department but could not because the telephone was put out of order by the lightning. The volunteer fire department was called by sounding the church bell, but the church burned to the ground because the fire department had no adequate supply of water. (H-23859.)

SWEDISH LUTHERAN CHURCH, FREMONT, KANSAS, JUNE 8, 1926. The church steeple, 150 feet high, was struck by lightning during a severe storm. The fire was discovered at once, but due to its height it could not be extinguished with the fire apparatus at hand. The fire burned downward and caused the bell to drop, scattering burning brands over the interior of the church and its shingle roof. There being no local fire department or fire protection, the church was completely destroyed. It was an ordinary brick church with wooden interior and roof construction. (H-23953.)

ST. PATRICK'S CHURCH, NEW ORLEANS, LA., JUNE 6, 1921. Lightning struck four small brick spires on the top of the steeple, demolishing part of each spire. An investigation showed that lightning rod air terminals were not grounded, the lightning thereby taking its course from the air terminals to the roof and through the masonry to the earth. (H-17515.)

Candles.

ST. MICHAEL'S CATHOLIC CHURCH, BUTLER, PA., DEC. 26, 1920. A small crib or manger had been constructed near the altar with a box near by to receive contributions. This manger was surrounded by lighted candles. Some boys entered the building and while attempting to abstract the contents of the contribution box they upset one of the lighted candles into the mass of straw in the manger, setting it on fire. The flames shot upward through a

P. & A. Photo.

The Mariners' Harbor Church, Staten Island, New York, burned in November, 1924. Church towers, usually rising high above the roofs of other buildings in the district, present a special fire fighting problem for which adequate fire fighting facilities are all too often not available.

partition, but were confined within the partitions and the open attic. Most of the loss was water damage. (H-16931.)

Wooden Interior Construction.

ST. THOMAS EPISCOPAL CHURCH, SIOUX CITY, IOWA, DEC. 9, 1922. This church was a mill constructed building with a frame roof. The fire was due to a furnace which overheated following the starting of a fire in it by the janitor. The fire got into the flooring and the interior wooden construction, and ascended to the roof in rapid time, being accelerated by varnished sheathing. The church was approximately half destroyed. (H-19232.)

Courtesy *Fire Engineering.*

Christ Episcopal Church, New York City, June 26, 1925. This fire is supposed to have originated under the tile-covered gabled roof. Ordinarily fires in the roofs of churches are quite inaccessible to firemen, but in this case the location of the structure permitted firemen to direct heavy hose streams from vantage points on near-by structures.

OLD STONE METHODIST CHURCH, MEADVILLE, PA., MARCH 11, 1927. This church had 18-inch stone walls with a wooden roof covered with slate. What caused the fire is not known. It apparently started in the auditorium of the church and spread quickly to the roof. A workman first saw the fire and turned in the alarm, apparently from a box some distance from the church, as the fire department appeared at railroad shops located at a considerable distance from the scene of the fire and a material delay was caused by failure of the fire department to locate the fire. In addition to burning out the wooden interior of the church, there was some damage to an adjoining building. (H-24361.)

Wooden Shingle Roof.

CENTRAL PRESBYTERIAN CHURCH, NEVADA, IDAHO, JAN. 25, 1925. The wooden shingle roof of this frame church was ignited by sparks from a fire in the chimney. No fire protection was available and the church burned to the ground.

Lack of Fire-stopping.

FIRST CHRISTIAN CHURCH, GREELEY, COLO., DEC. 31, 1922. Fire destroyed this church, leaving only its brick and concrete walls standing, with a loss of about $35,000. The building was one story and basement, with brick and concrete walls and wooden shingle roof. Interior partitions were ordinary lath and plaster without fire-stopping. The furnace room in which the fire started was located in a corner of the basement and entirely cut off from the rest of the basement by brick walls, but had an ordinary wooden lath and plaster ceiling. The fire evidently started from an overheated hot water furnace which had been recently fired by the janitor and left unattended.

An early attempt was made to fight the fire with garden hose, but it spread into the wooden ceiling above the boiler through a break in the plastering. The open floor joists and the hollow partitions quickly carried the fire to the rest of the building. Unintelligent fire fighting enabled the fire to spread rapidly, no attempt being made at first to use hose streams. The fire shortly broke through the roof and the fire department devoted its attention to keeping the roofs of neighboring residences wet down. The principal contributing factors in this fire were the heating boiler and its pipes too close to a combustible ceiling, and the lack of fire-stopping in the church structure itself. (H-19262.)

Exposure Fire.

BAPTIST CHURCH, PE ELL, WASH., JULY 6, 1926. Fire swept an entire block of this community. It started from a grass fire which communicated to a wood shed and thence to a store building. From this first store the fire spread to an adjacent garage and continued to spread in spite of three hose streams which were directed by the local volunteer fire department.

In 30 minutes the flames had spread to a dry goods store and a dwelling in one direction, and to another store and the Masonic hall in the other direction. At this point some dynamite was secured and a building in the path of the fire on the corner of the block was blown up to prevent the spread of the fire to another block. Fire in the other direction, however, fanned by the wind, jumped a street and ignited a hotel and a restaurant building. From these fire communicated to the Baptist Church and an adjacent garage, which latter served to stop the flames in that direction. The church and its adjoining parsonage were completely destroyed.

All the buildings involved in this fire were frame, and although there was an ample water supply and a good volunteer fire department, the wind spread the flames rapidly from building to building. (H-23594.)

Loss of Life in Church Fires.

While no great catastrophes in churches of the United States and Canada have occurred to cause public concern about the life hazards in this occupancy, there have been a few cases of serious loss of life in other countries, the details of which are too little known. Mr. Clarence Heller (member N.F.P.A.), in an article in the October, 1922, QUARTERLY (Vol. 16, No. 2, p. 166), refers to a catastrophe in the destruction of a church in Santiago, Chile, in December, 1883. In this fire panic occurred and some 2,000 people were killed and only about half as many saved. He also refers to a fire in a church in Pisa, Italy, in 1898, where decorations became ignited and 12 people were said to have been crushed to death and 20 injured in a panic which followed.

There has been loss of life in at least three church fires in the United States, which fires are briefly described below. However, in these fires the loss of life had nothing to do with the fact that the building was used as a place of public assembly. Two of the fires were caused by gas explosions, and in the third a collapsing wall killed four firemen.

The fire in the Rialto Theatre, New Haven, throws light on the possibilities of loss of life in churches. This theatre was simply an old church building which had been put into use as a theatre without any change in arrangement or construction. A brief report of this fire follows.

RIALTO THEATRE FIRE, NEW HAVEN, CONN., Nov. 27, 1921. This building consisted of a basement and a single high story 60 ft. by 100 ft. with joisted floor and roof supported by heavy wooden trusses. The balcony was of frame construction supported by wooden posts. The building formed one single fire area, as the stage was not cut off, even by an asbestos curtain. The heating boiler was in the low basement directly under the open joist orchestra floor and not cut off. Window openings were protected on one side only. The tin clad shutters on these windows failed under the intense heat of the fire. The building was unsprinklered, and the only inside protection was a few chemical extinguishers. It is believed that one of these used by a stage hand at the first sign of fire failed to operate.

The above combination was certainly sufficient in itself to cause trouble, but the last straw came on the evening of Sunday, November 27, 1921. To provide atmosphere for an oriental production, the stage was draped with flimsy gauze, and burning incense provided. The theatre was packed to the doors and several hundred persons were waiting outside in the lobby for a second performance. At a few minutes past seven the incense and draperies came in contact and in an incredibly short time the flames had gained rapid headway, spreading out over the heads of the audience. Panic and a jam at the exits ensued. There were exits on three sides of the building. Everyone, however, rushed to the rear. One of the balcony fire escapes passed a window on the first floor and when the flames broke out of this window, no one could pass down. Two people were found dead on a firescape and two more died before they reached the hospital. Three died later from burns and injuries inflicted by the mob. Hundreds of others received burns and bruises. (H-18020)

Underwood and Underwood.

Notre Dame Basilica, Quebec, P. Q., Dec. 22, 1922. The roof and interior of this stone walled church were of wood. There was a seminary building and residences of the priests and bishop adjacent to the church. The origin of the fire is unknown, but has been variously assigned to electric wiring and incendiarism. When the fire department arrived a considerable portion of the church was ablaze and the department, though seriously handicapped by lack of water, did good work in confining the fire to the church proper and preventing its spread into adjoining buildings.

There was no circumstance in the Rialto Theatre fire which could not have been duplicated had the church been in use for its original purpose. Whereas formerly church buildings were used solely as places of worship, they now often have rooms for entertainments such as dances, fairs, or motion pictures, which bring the hazards normal to these activities into the church building. One hazard which should be noted is the danger brought about by the revival of candle-light services in which each member of the congregation is given a lighted candle. Such open lights are also frequently carried in ceremonials and may readily ignite dresses or veils of flimsy material. Mr. Heller reports a case such as this, when, on Aug. 3, 1922, a woman's clothing caught fire from a candle in the church of the Holy Redeemer in San Francisco. The burns the woman received proved fatal.

Courtesy *Fire Engineering.*

Fighting the fire in the First Methodist Episcopal Church of Kalamazoo, Michigan, on March 13, 1926.

An interesting loss of life fire in a church is reported by Sidney G. Gamble, a former chief officer of the London, England, Fire Brigade, in his book, "A Practical Treatment on Outbreaks of Fire." His story follows:

"A very serious fatal fire occurred in Hamburg (Germany), July 3, 1906, through the carelessness of workmen engaged on repairs in a church tower. This tower, which was chiefly constructed of wood, was about 220 feet high, and a portion was in use by the fire brigade as a watchroom, and was equipped with signaling instruments and sundry fire appliances. The workmen were employed at a level below the watchroom. In broad daylight the fire broke out and was repeatedly signaled from the watchroom above to the fire brigade headquarters. For some reason, however, the brigade were bewildered by the frenzied incoherent signals and wired back time after time "Where is the fire?" until finally one last hesitating signal came through "Big fire here in the tower." It is to be hoped that carbon monoxide did its merciful work before the flames reached the wretched men and wrapped them with the tower in utter destruction. All the men perished."

Loss of Life Fires in Churches.

CHAPEL OF LATTER DAY SAINTS CONGREGATION, TURNER, IDAHO, JAN. 27, 1927. Six persons were killed and more than 12 seriously injured as a result of an explosion of acetylene gas which wrecked the chapel and recreation hall during a basketball game. About 200 persons were assembled in this one-story frame building, and shortly after the play had started the lighting system failed. Someone struck a match and a terrific explosion followed, wrecking the rear wall of the building.

As the players and spectators started for the remaining exit at the front of the building, a portion of the ceiling fell, hurling timbers and plaster into the crowd. Most of the dead and many of the injured were found near this exit. The body of the janitor was found in the basement, where he had apparently gone to inspect the lighting system tanks. Some of the injured said that they were literally blown from the building. Others near the door found little difficulty in escaping. No details as to the reason for the explosion are available, as the building was completely destroyed. (H-24199.)

JACKSON AVENUE EVANGELICAL SUNDAY SCHOOL, NEW ORLEANS, LA., MARCH 7, 1921. Four firemen were killed and one was injured due to the collapse of the walls of this Sunday School and Parish House. It was a two-story, brick joisted building with 12-inch brick walls. This wall was at least a 12-inch parapet with ordinary openings in each floor, which openings made up more than half the area of the wall. The wall was not pilastered or buttressed except by ordinary frame lath and plaster cross walls.

The fire originated within the building, burning away frame cross walls and reaching the roof. As the fire progressed, floor joists and roof timbers released cleanly, leaving the brick wall with a heavy superimposed load of brick cornice totally unsupported. Pressure due to expansion within caused this wall to topple over and kill four firemen. (H-17282.)

FIRST CONGREGATIONAL CHURCH, TOLEDO, OHIO, FEB. 5, 1927. This was an old church building of ordinary brick and joist construction being used as a community house. Three persons had entered to do cleaning and shortly thereafter a terrific explosion followed, which completely wrecked the building. What happened is not just known, but because the electric lights in that section of the city were out on account of a sleet storm, one of the cleaners probably lighted a match which ignited an accumulation of gas.

After the fire the service pipes for both artificial and natural gas were tested and the pipe supplying natural gas was found not to hold pressure. When it was dug up at a point about 10 feet from the building it was found to be badly rusted and to contain several small holes. The investigation led to the conclusion that the accumulation of gas was due to this defective service pipe which had allowed gas to seep into the building through some crack in the wall. The pipe had been installed in 1905, laid in cinders. (H-24226.)

Oroville, Cal., Lumber Mill Fire.

Report by Lumbermen's Underwriting Alliance.
(Member N.F.P.A.)

The Feather River Mills at Oroville, Cal., were destroyed by fire on October 6, 1927, with a loss estimated at $2,500,000. This modern plant was built in 1920, and in 1926 and 1927 considerable money had been spent on improvements. The plant was partially sprinklered and plans for completing the sprinkler installation over the entire property were under way at the time of the fire.

The day after the fire eleven hundred men were laid off who had been employed in the plant and in camps in the woods.

The Story of the Fire.

On the afternoon of October 6 one of the inspectors of the Lumbermen's Underwriting Alliance was on his way to Oroville. On reaching Oroville Junction, about 20 minutes' run from Oroville, he was somewhat alarmed by the appearance of thick black smoke some miles away. The train reached Oroville at 6 P.M. He immediately joined a taxi procession, all journeying in the same direction, and by 6:30 had covered the three miles to the Feather River plant. He arrived just in time to see the sawmill burst into flames. The other buildings were already burning, with the exception of the office, which stood on a hill across the road from the plant. Men were working desperately on the roof of this building, extinguishing sparks and cinders with wet sacks; but with such slight hope of success that the records were loaded into a truck and sent to Oroville for safe-keeping. The persistence of the workers finally won out, however, and in the early dawn of the next morning the office building, like a grim sentinel, looked down upon the ruins, the sole survival of the conflagration which swept this big, modern and practically new plant.

A Rubbish Pile the Origin of the Spark.

It had been the custom to haul sweepings from the mill buildings—edgings, sawdust and other litter—to a dump located some 400 feet or more north of the dry shed and outside the fence. Gravel piles over hundreds of acres of land, the result of past placer mining operations, are seen when looking north from the plant property. It is among the rocks and gravel that the rubbish dump is located, apparently a safe spot and at a safe distance; but the disastrous results proved that such dumps should be located a thousand feet from any division of the plant property to be out of range of sparks carried by gales like that which was blowing at this time.

Fireman's Fund Record.

At 5 P.M. on October 6 the Feather River Lumber Mill at Oroville, Cal., was a busy plant furnishing employment for 1,100 men.

Fireman's Fund Record.

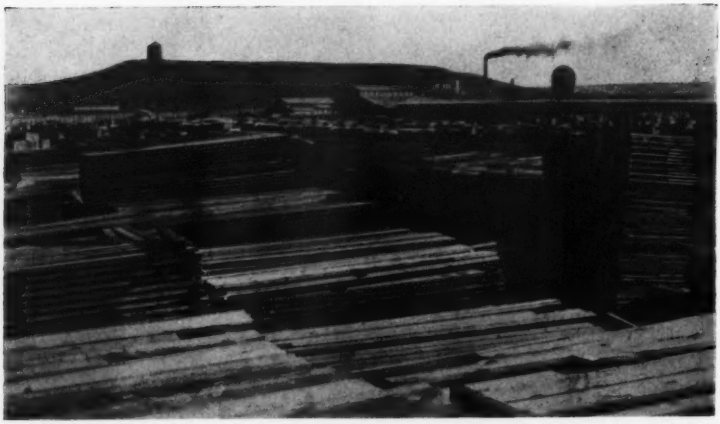
An hour later all hope had vanished of saving any part of a $2,500,000 investment. The red glare in the sky was seen from a hundred miles away.

American Lumberman.

Interior of the shed where fire was discovered and through which the flames traveled with lightning-like rapidity.

Prevailing winds at this plant are north and south—usually from the south during the summer months; but frequently, as was the case at the time of the fire, there is a very high wind from the north. The inspector says that even when he first reached the plant he had difficulty in keeping on his feet and was compelled to hold his hat on his head. As the mills and remaining large buildings were drawn into the general maelstrom of flames, the draft created by a quarter mile of blazing buildings was so furious that the men who would willingly have fought the fire with desperate persistence were forced to flee at breakneck speed from the onrush of flames. In some instances there was not even time to shut off the water turned on in the early efforts to use the hose.

As in a large percentage of the most serious lumber mill fires of the past few years, the start of the fire was in a lumber shed—the dry shed in this instance. Whether a spark from burning rubbish at the dump landed at the shed, or whether the fire had traveled, undiscovered, over a trail of dry grass in the space intervening between refuse pile and shed was undetermined; but bursting into the shed at the northwest corner, the flames swept through the building, from west to east, and, driven by the wind, whose velocity steadily increased, forced their way into the remanufacturing plant, select sheds, planing mill and box factory, on toward the green chains, beyond which lay the sprinklered sawmill, the heart of the large operation.



A million dollars' worth of lumber was destroyed here, though separated from the buildings by a clear space of 195 ft. The office building in the left background was saved. The 100,000-gal. tank, which proved a wholly inadequate water supply, may be seen on the skyline of the hill.

Discovery and First Action.

It is the inspector's understanding that rubbish was burned at the dump only on calm days, taking due precaution against the spark hazard—and that none had been burned on the day of the fire. Whether ignition in the refuse was spontaneous or was caused by a pipe or cigarette of a workman driving a dump wagon or otherwise engaged in work about the trash pile is undetermined. There seems to have been no other source of sparks in this vicinity.

The fire at the rubbish heap was first noticed by the superintendent of construction, who, with his crew, was erecting an addition to the large dry shed. He at once took his men to the dump and after a consultation with the fire chief and other supervising plant employees, hose was taken from several huts near the shed and remanufacturing plant, together with a section or two from a reel cart in this vicinity, as a line 400 feet in length was necessary to reach the fire. The water had scarcely been turned on the blaze when one of the men, turning toward the plant, saw flames bursting from the northwest corner of the dry shed. Immediately the men ran back to the shed, dragging the hose with them; but by the time they reached the building the flames had eaten through it into the congested area in which were situated the planing mill, factory, remanufacturing plant and select sheds.

Unsprinklered Area Too Great.

The green chain shed was partially sprinklered, and there was some hope that the flames might be checked at this point. The sprinkler heads under that portion of the green shed so equipped were opened by the fire-fighters,

and for a short time retarded the progress of the fire. But, owing to the failure of the water supply—both fire pumps having gone out with the transformers, some of which were blown out about this time—there was nothing human power could do to stay the march of the flames, already under such furious headway, through the sawmill and through the large lumber yards lying to the east. The shift of the wind at this time toward the yards and the absence of water made wholly ineffective the effort to create a fire break by the use of dynamite.

The Inspector's Narrative.

The following narrative of the inspector gives a vivid picture of the fire at its height.

After reaching the office and talking to President Land a few minutes, holding our hats and bracing ourselves against the terrific wind, we moved up farther on the hill to think it over and because there was no better place to go. I never felt so helpless in my life. Here was a million dollars' worth of lumber in the yard and the fire just starting into it along the north end—and nothing could be done but stand on the hilltop and watch it burn!

By 9 P.M. the plant was on the ground. The sugar pine yard across the pond, about in line with the big shed where the fire started, was fired from one end to the other, and from the high side hills the view of the pond resembled a deep crater—a seething, crackling mass of flames; from a distance spectators saw a wall of flame which appeared nearly a mile in length.

I saw boards at least ten feet long carried up a hundred feet in the air like matches. I know they were heavy, for I saw some of them hit the fence when they landed. The powerful wind increased in force, and a column of black smoke, possibly 15 feet in diameter, would shoot straight up to a distance of a thousand feet or more. A funnel of flames would be forced skyward by the strength of the roaring draft, drawing up millions of sparks and showering them on the hillside near by into the dry grass, which immediately caught and, unheeded, this grass fire burned south toward Palermo. Sheets of metal or steel got into the whirl and, added to the uproar of the flames, caused a drumming sound that gave one a feeling of some fiendish supernatural power directing the destruction we were gazing upon, and throwing into the caldron of burning lumber a few more piles now and then to complete the illusion of "hell fire everlasting."

Weaknesses Developed by the Fire.

It was natural that the construction foreman, on noticing flames at the dump, should hurry, with his crew and all the hose they could get hold of, to extinguish the fire. It was most unfortunate that they did not know of the far more important outbreak just ready to occur at the shed. The absence of men caused the flames to get under headway undiscovered, and the absence of hose lines at nearest hydrants doubtless retarded the action of those who first reached the shed.

"It was greatly regretted," said the inspector, "that the situation chosen for the pump was in a congested part of the plant, tied into the large non-sprinklered areas by a number of dwellings and sheds. Only part of the yard was protected by hydrants—a small part of it—but the water supply was so limited that further hydrants in the yard would have been ineffective."

Ruins of the tile and concrete dry kilns, mute evidence of the fallibility of fire-resistive construction under severe fire exposure.

Transformers should never have been located in the congested area about the boiler house, for in so doing the pump on the hill (although not a fire pump) was cut off from rendering what assistance it might otherwise have given.

In addition to the apparent lack of immediately available water in adequate quantity inside the dry shed, the exterior hydrants were not favorably enough located with respect to interior to be of great help, and the inspector was told that there was a delay in getting hose streams into action because of the hose from some of the exterior hydrants having been taken to the refuse dump. Absence of men prevented timely use of extinguishers or water from barrels.

A fire alarm system would doubtless have brought quicker aid. The fire whistle was not blown until after the flames had spread through the shed and were under such headway that control was impossible.

The need of assistance from the city had evidently not been figured on. The Oroville fire department, although not obligated to respond to this fire, did so with all good will, but was unable to be of service because there was no roadway to the pond, from which it must draw its supply of water, except through the congested and burning part of the plant.

A complete sprinkler system with adequate water supply would probably have averted this holocaust.

The Beauval Mission School Fire.

A fire in an Indian Mission School at Beauval, Lac La Plonge, Saskatchewan, in the North Country of Canada, took a toll of twenty lives on the night of September 19, 1927. Beauval is so remote that it was three days before any report of this tragedy appeared in the newspapers, and a week before an officer of the Saskatchewan Provincial Police, traveling by canoe, reached Beauval to conduct an inquest. The following account is based upon the report of the Saskatchewan Provincial Police, made available through the courtesy of Mr. Walter J. Blackburn, Secretary of the Western Canada Insurance Club (Member N.F.P.A.).

On the night of September 19, 1927, at half past eleven o'clock, a fire broke out in the school building of the mission post, Beauval, at Lac La Plonge, Saskatchewan. Nineteen boys, between the ages of seven and fourteen, and the Sister in charge of them were burned to death while attempting to escape from the burning building. Thirty-six girls and eight Sisters managed to leave the building in safety.

The building was a three-story frame structure, about 120 feet long. It was lighted by electricity, the electric plant being some little distance from the school. There was a furnace in the basement connected to a chimney constructed of galvanized iron. There were five stairways: two on the outside of the building at either end, one in the center, and one at either end inside of the building. The school was equipped with chemical extinguishers.

The sleeping quarters of the boys and the Sister in charge were at the south end of the third floor. The girls and other Sisters occupied the second floor and the north end of the third. Where the fire started and its cause are not known. It is supposed that it started from the furnace or from the galvanized iron chimney of which one of the joints may have been loose and allowed the fire to reach the wooden walls. At the start the fire was mostly in the center of the building.

The Sister Superior was wakened by a crashing noise. She saw the light reflected by the fire and rang the bell that served as a fire alarm. Due to the training in fire drill, there was no panic among the girls. They did not stop to dress, but rolled their clothes in blankets. The older girls waked the little ones, according to their drill system, rolled their clothes for them and guided them out of the dormitories. They left the building by the north outside stairway. Because of the dense smoke, the Sister in charge could not be sure that all had left. On finding them all outside, she realized that their safety was attributable only to their previous training.

Nineteen boys and a Sister in charge were burned to death on September 19, 1927, in this mission school at Beauval, Lac La Plonge, Saskatchewan, in the North Country of Canada.

Meanwhile the Sister Superior was going through the corridors on the second floor waking the other Sisters. She saw the fire in the center of the building which blocked all exit from the main stairway and led the way out by the second floor south exit to the outside stairway. The opening of the door at this point caused a draught and doubled the rapidity with which the flames were consuming the building.

The Sister Superior ran up the south outside stairway to the third floor. Breaking a window, she cried a warning to the boys' dormitory. These children, being younger than the girls, were not so well trained in fire drill. If they had been they might have left their dormitory by way of the outside stairway on the south end before or simultaneously with the Sisters. As it was, by the time they had collected their bearings, they found this exit completely cut off by the flames that shot up past it, directed that way by the draught set in motion when the Sisters opened the door.

The boys and the Sister with them found themselves surrounded by a circle of flame. They blindly rushed for their accustomed exit in the center of the building which led down to the second floor. This was a very narrow staircase with room for only one person to pass at a time. There was a door at the foot. The bodies of the boys and the Sister were found in the ruins of the basement in a spot corresponding with the location of this staircase. Either there had been a jam behind the closed door, or having gone through the door, the floor gave way and they all fell into the burning basement.

The time consumed thus far since the first alarm was about four minutes. One of the Fathers, who had come from a near-by cottage, emptied the con-

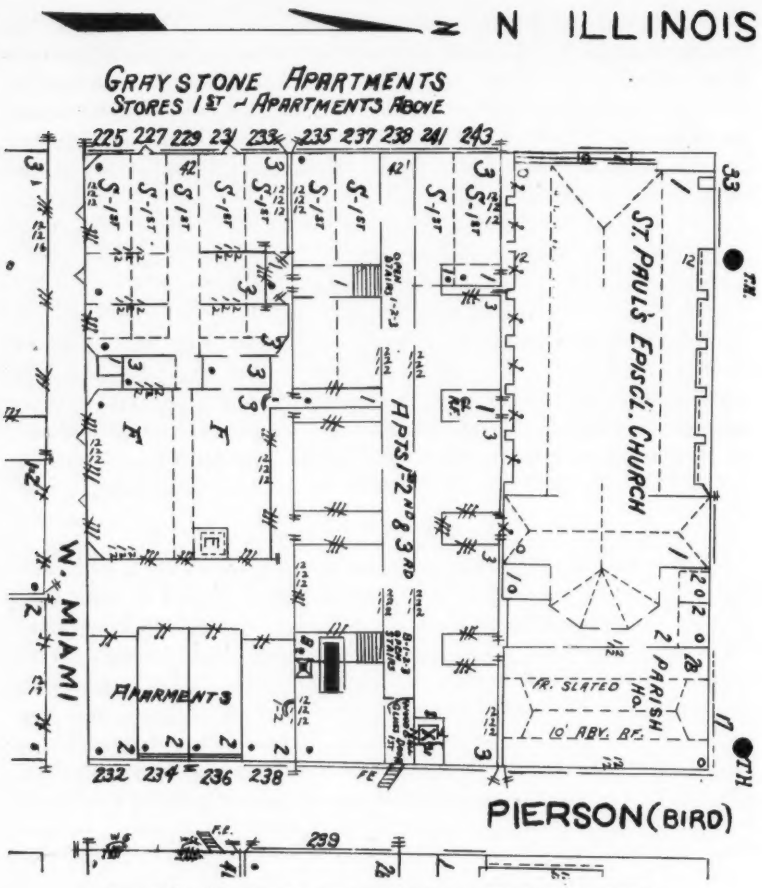
tents of several chemical extinguishers on the flames at the outside door through which he hoped to see the boys come. But within five minutes the frame structure was in flames from end to end. Some attempts were made to reach the boys with ladders, but these caught fire as they were placed against the building. Without adequate facilities to check the progress of the fire, the Fathers and near-by residents saw the building collapse in a mass of ruins within an hour after the outbreak.

Graystone Apartment Fire.

Nine lives were lost in the Graystone Apartment, Indianapolis, on the night of November 12-13, 1927, in a fire which spread rapidly because of unprotected vertical openings, but which caused a relatively small property damage. The fire was largely confined to the open corridors and the loss of life was in the main due to people rushing into the corridors. Those who remained in their rooms with the doors closed suffered no casualties.

Construction and Occupancy.

The Graystone Apartment is comprised of a group of three brick buildings located at 225-43 N. Illinois St., Indianapolis, a district of concentrated values. The main section in which fire occurred with resultant heavy loss of life is known as 235-43 N. Illinois St., extending entirely through the half block to Pierson Street, a 30-ft. thoroughfare. This section communicates with each of the brick buildings adjoining on the south through single openings on the first floor, each protected by one standard fire door and one opening on the second floor to the rear building protected in the same manner. The two main buildings in the group were formerly known as the Roberts and Roberts Annex Apartments with apartment occupancy exclusively. In recent years the apartments have been removed from the first floor, front, and small mercantile tenants substituted. The layout is shown by the accompanying sketch. The main section, to which the fire and loss of life was confined, is three stories and basement with ordinary joisted wood floors and roof supported principally on exterior brick walls and interior brick corridor walls. There are two open, ordinary hallway type stairs, one first to third, one basement to third, and one hand elevator basement to third enclosed in an 8-in. brick shaft with light wood non-automatic doors. A wide hallway runs the full length of the building on the first, second and third floors. There are street doors at both ends on the first floor, and on the upper floors ordinary windows at the west end and wood and glass doors at the east end, giving access to a small fire escape on Pierson Street. The north court-ways are not accessible from the street, but the south court-way can be reached readily



Graystone Apartment. Cross indicates point of origin of fire.
Approximate scale 1 in.=75 ft.

from the alley on the south. The walls and ceiling of the hallway on the first floor were painted only, but on the second and third floors were covered with paper of from five to seven thicknesses. A break in the hall on the first floor is obtained by ordinary swinging glass doors installed just west of the elevator shaft. Except for a storage basement and four mercantile tenants on the first floor, the entire building is divided into small apartments of from one to three rooms, mainly of the one- and two-room variety. The entire apartment group comprises some 321 rooms.

Story of the Fire.

There is very little doubt that the fire started on the freight elevator itself, which was at the first floor level and is said to have had on it a considerable quantity of paper and rubbish. The small vestibule located between the elevator and Pierson Street gave access to the street through wooden doors which were found closed by the firemen. However, it is believed that the fire escape doors on second and third floor hallways were open at least partly. The fire was discovered at 11:55 P.M. on November 12, 1927, and the first alarm registered at 12:01 A.M., November 13; the second alarm at 12:06 A.M. Unusual draught conditions must have prevailed, as investigations reveal that a check-up of the elevator vicinity was made as late as ten minutes preceding the fire and that no smoke or fire was noticed. This check-up was obtained through people leaving the building via the rear doors at the time. The fire caused very little property loss on the first floor, but was drawn up the elevator shaft as in a flue and fanned the entire length of the hallways on second and third floors, blistering and charring wooden doors and trim, consuming the heavy layer of paper on walls and ceiling, and gaining access to the attic space and pent house over the elevator. The fire progressed with such celerity that tenants, many of whom were no doubt asleep when the alarm was given, had little chance to escape through the halls, and in view of the fact that the victims were mainly women and children it is probable that hysteria was largely responsible for the appalling life loss. From a fire fighting standpoint, this fire was handled admirably and brought under control quickly. The assertion has been made that had all tenants remained in their respective rooms with doors shut and leaned out of the windows there would have been no casualties. It is claimed that a parrot and canary bird in one apartment located about midway of the building, north side on the third floor, survived. The total casualties—nine lives—as follows:

Name	Age
Mrs. Erma Busselle	41
Miss Elizabeth Busselle	17
Miss Stella Kimberling	About 45
Miss Ruth Rawlins	9
Mrs. Jessie P. Campbell	38
Miss Alice Furr	48
Mr. Roy Zimmerman	37
Miss Clara Allen	54
Lieut. Weishaar	About 48

It is impossible to say whether the unfortunates died from suffocation or actual burns. Mrs. and Miss Busselle evidently escaped from their apartment and isolated themselves in a bathroom located near the center of the building, third floor. Either they left the door to the bathroom open or it was blown open and suffocation resulted. Loss was negligible in the bathroom and

though the finish on the door was blistered there was a noteworthy lack of actual charring. Two of the occupants of the third floor were found in the hallway about midway of the second floor. Except for these two, all casualties were on the third floor. Miss Kimberling with Ruth Rawlins were found in the hallway on the third floor. Mr. Zimmerman's body was found hanging over the stair bannister on the third floor and the supposition is that he turned back presumably to hunt for his wife, who had already escaped, and was overcome and collapsed at that point. Miss Allen's body was found in the hall near the front stair, third floor; she probably ran through the fire in the hall, collapsing near the stair. Lieut. Weishaar of the fire department was overcome by smoke and died later, but probably through other complications. Minor injuries were suffered by several people in jumping from windows.

Immediately after arrival the fire department ran ladders to the windows at all accessible points and approximately forty-one people were taken from the building in this manner. The fire loss was nominal, amounting to less than $20,000.

While the time and place of the fire origin have been definitely determined, the actual cause is not known. No details tending to support the theory of incendiarism have been discovered. The cause could have been a cigarette carelessly tossed on the rubbish in the elevator, spontaneous ignition, or other cause. The fact remains that there was sufficient combustible material on the elevator and in the vicinity to carry the fire upwards and strong enough draught in the upper hallways to carry the flame down the papered hallways from end to end. The unprotected elevator shaft offered no resistance to the spread of fire. Stairways deemed adequate for exit were of no avail, due to rapidity of fire travel, perhaps due to papered walls and ceilings in hallways. The fire escape located at the east end adjacent to the elevator shaft was valueless. One fire door in the path of the fire was kept closed and proved effective in preventing spread to other fire divisions. This door positively eliminated draught from one building to the other. It appears that one of the greatest incentives in protecting vertical communications throughout buildings is that of qualifying draught conditions. It is also worthy of note that the wood and glass doors installed across the hallway on the first floor prevented any strong air current through the hall on that floor, thus serving to alter the direction of the fire spread. These doors were undamaged.

New Rochelle Oil Fire.

Report by National Board of Fire Underwriters.
(Member N.F.P.A.)

At shortly before 6.30 P.M. on October 31st, a fire occurred at the plant of the Pure Oil Company at New Rochelle, N. Y. This plant adjoins that of the Standard Oil Company; the general arrangement of buildings and tanks is shown by the accompanying plan and photograph.

The fire originated within the dike enclosing the two Pure Oil Company tanks, labeled 1 and 2 on the plan. These tanks are of all-steel construction, one being 25 feet high and 18 feet in diameter, and the other 26 feet high and 18½ feet in diameter. Their respective capacities are 56,000 gallons and 59,000 gallons. Each tank is provided with a 2-inch vent and a circular explosion hatch about 2 feet in diameter; the latter are provided with hinged covers held in place by weight only, and arranged to close automatically when opened by pressure from within.

The tanks are located on low ground not far from the bay and 18 feet below the grade of and close to Echo avenue; one tank is located only 7 feet from the street line.

By ordinance, a tank must be enclosed by a dike holding 1¼ times the tank capacity. These two tanks are too close together to permit the erection of separate dikes, hence a single rectangular, reinforced concrete dike, 51 ft. x 27 ft., was constructed enclosing both tanks; the east wall is built against the side wall of the 2-story mill constructed warehouse, and the west wall against the bank extending up to Echo avenue. The dike walls form an enclosure or pit ranging in depth from 11 to 13 feet. Both tanks were equipped with a foam system; the power line to the pumps was overhead and in close proximity to the tanks.

On the afternoon of the day in question, the two tanks were being filled by pumping from a barge located in the bay. Shortly after 6 P.M. the fire department was notified that one tank was overflowing. The Deputy Chief started to investigate, but before he reached the plant an explosion occurred; on arrival he found the pit on fire, the flames reaching a considerable height. A light northeast wind was blowing at the time.

The explosion destroyed the foam system power lines and it was only after considerable delay that an emergency line was established, connected to the pump motors and foam discharged into the tanks and pit. A portable foam generator from a near-by city was also used in an attempt to extinguish the fire in the pit. In the meantime the fire department pumped water into

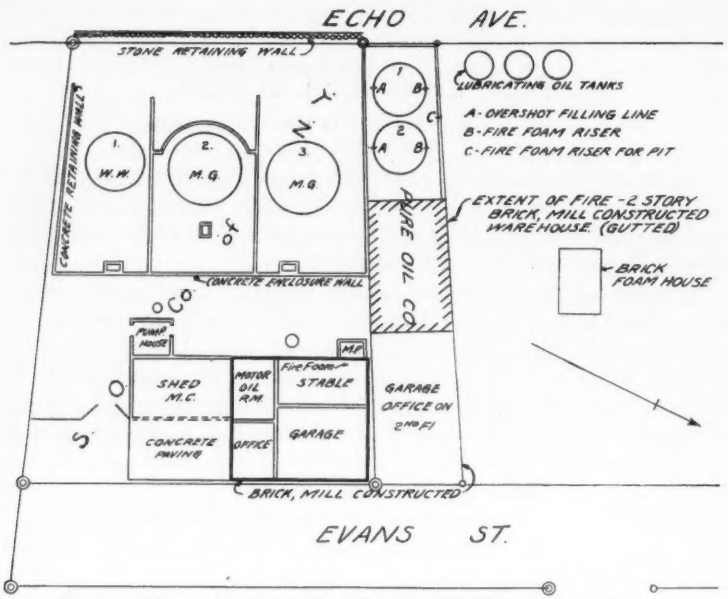


Diagram of area involved in New Rochelle Oil Fire, October 31, 1927.

the pit in order to keep the gasoline floating on the surface and to prevent it from seeping through the ground to the near-by bay. The foam did not appear to be of great value, but this may have been due to the fact that hose lines were being played into the pit at the same time. It is also well established that much of the foam discharged under such conditions is carried away by the up-draft of the fire, some is broken up by the fire, and that only a greatly diminished amount reaches the seat of the fire.

The fire spread to the Pure Oil Company's 2-story brick warehouse immediately adjoining the tanks on the east, and destroyed a considerable portion of it. It also blistered the nearest tank of the adjoining Standard Oil Company plant on the south. On the west the heat radiation caused the tar in the composition roofing of a frame dwelling 70 feet away to melt, ignition being prevented by hose streams. The fire burned until about midnight, apparently consuming the entire contents of both tanks.

With reference to origin, it is probable that during the filling of these tanks a considerable quantity of vapor was discharged into the pit, since conditions after the fire plainly indicate that the explosion occurred within the pit. If, as reported, one of the tanks overflowed, the presence of vapor within

New Rochelle oil fire. View looking west from Evans Avenue, showing tanks and destroyed warehouse. Pure Oil Company tanks indicated by figures "1" and "2." Standard Oil tank which floated from base indicated by "x."

the pit is accounted for. The dike or pit is of such depth as to form a pocket not readily cleared of vapors by normal air currents, hence it is probable that the presence of vapors therein was a more or less permanent condition. A board fence had been built along Echo avenue and it is possible that vapors seeped through this to a point where means of ignition were afforded and resulting in a flash-back to the pit, or some one may have thrown a lighted match over the fence into the pit.

An inspection of the tanks failed to disclose any open seams, but the explosion had apparently broken the pipe lines leading into the bottom of the tanks. The roofs of the tanks were found intact, so it is evident that gasoline was discharged through the broken pipe lines and not through any rupture of the tanks. While considerable internal pressure was created by the fire, the venting facilities provided were evidently sufficient to safely relieve it. In this connection, it was stated by the officer in command at the fire that the covers of the explosion hatches were seen to open and close at frequent intervals during the fire.

An interesting feature of this fire was its effect on the adjoining plant of the Standard Oil Company, where building construction is of mill and metal clad types. The buildings were not damaged. The three tanks, as shown on the accompanying plan, are of all-steel construction, each equipped with two 2-inch vents of the vacuum and pressure relief type. These tanks are provided with fill lines which enter at the bottom, and each also has an overflow

or return line to prevent overflowing of tank. Fill line connections to tanks are made by swing joints. A dike consisting of 3 bays encloses the tanks. At the time of the fire the tank closest to the Pure Oil Company's plant contained about 4,000 gallons of gasoline, an amount sufficient to take up about one foot of the depth. As a result of water discharged past the flames, the bay in which the last mentioned tank is located was filled with water and the tank floated off its base; the swing joint functioned, however, no pipe connections were broken, and no oil was lost. The tank was only slightly blistered on the side exposed.

This fire illustrates the good performance that may be expected from properly constructed and vented all-steel tanks. On the other hand, it illustrates in a striking manner how the benefits of good tank construction can be largely lost through failure to properly safeguard piping. An emergency valve inside or immediately adjoining the tank with provisions for closing from outside of dike is also indicated as necessary. This fire also indicates that a dike so deep as to prevent easy ventilation may permit conditions to arise where a considerable explosion may occur. Had the tanks involved by the fire been provided with overflow return lines and with swing joints on outlet or fill lines, as in the case of the Standard Oil tanks, it would not have been possible to overflow them during filling operations, and a rupture of the piping might not have occurred.

The Pittsburgh Dry Goods Company Fire.

Report by W. K. Estep (Member N.F.P.A.)
Board of Fire Underwriters of Allegheny County.

The Pittsburgh Dry Goods Company fire, which occurred in Pittsburgh on the night of October 16, 1927, caused a loss of over $1,000,000, and is interesting because of a number of unusual features. The regrettable loss of two fire captains, the disastrous property loss, and the particular circumstances of the fire all contribute to render this fire both technically and generally interesting.

The Pittsburgh Dry Goods Company occupies numbers 933-943 Penn Avenue. This company, doing a wholesale business only, had their building stocked with all kinds of dry goods, rugs, linoleums, bedding, etc. Next to it on its west side is number 931, occupied by the Broadway Cloak & Suit Company and William Perlman Company, milliners. The next building on the west, number 929, was occupied by the Ludwig Hommell Company, merchants with a complete line of radio and electrical supplies.

Number 929 (see diagram) was a structure of six stories and basement of good brick and joisted construction. The right and left walls were blank brick, and front and rear walls brick with large plain glass windows in wooden frames and sash, unprotected. It contained elevators and stairways enclosed

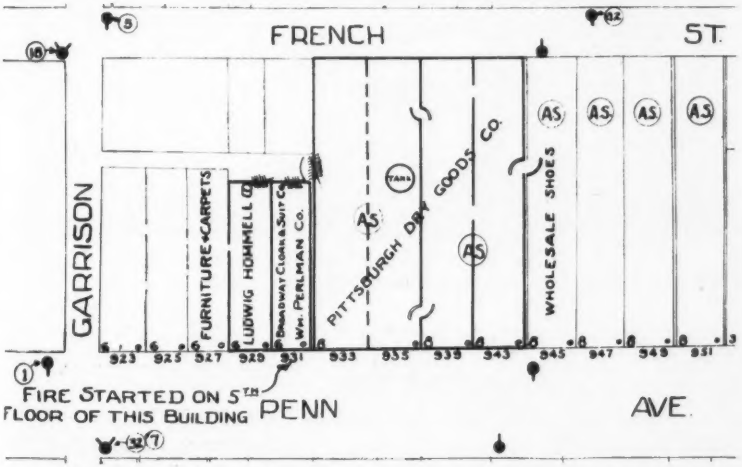
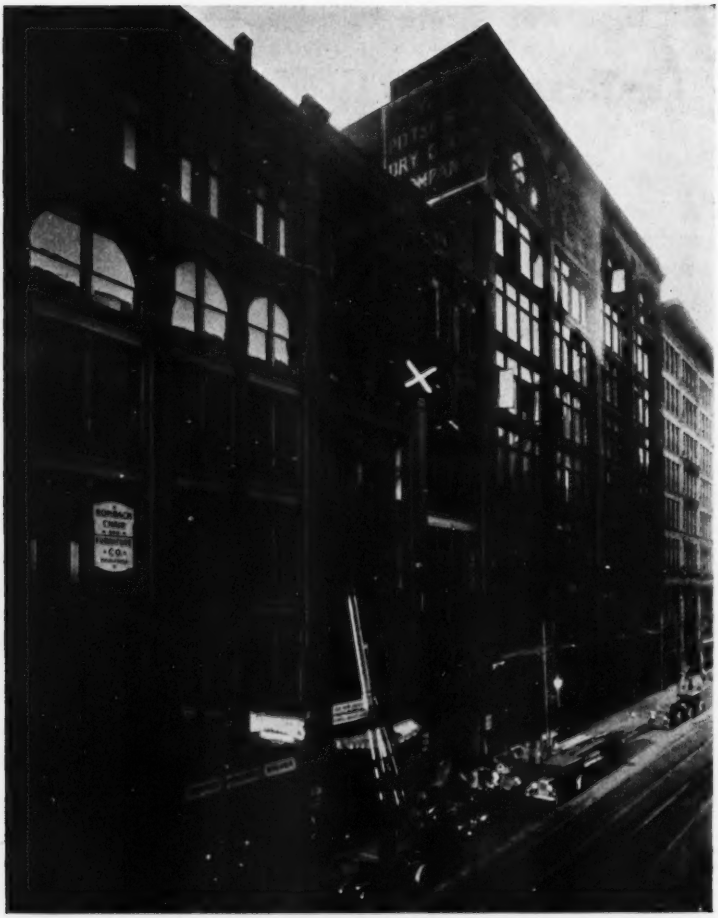


Diagram of Pittsburgh Dry Goods Company building and adjoining structures. Approximate scale, 1 in.=100 ft.



The Pittsburgh Dry Goods Company building and adjoining structures on Penn Ave. Fire started at approximately the point marked by the cross.

in non-standard manner or equipped with automatic trap doors. The floors were double $\frac{7}{8}$-inch wood on three by fourteen-inch joists, and the roof was composition on wood sheathing.

Numbers 933-943 inclusive, the Pittsburgh Dry Goods Company, formed a structure of eight stories and basement of steel frame construction with brick curtain walls and unprotected steel columns and girders. The left wall facing number 931 was blank except for a tier of windows facing a blind alley. This alley was fifteen feet in width, running at right angles from the side of

this building into Garrison St., its two sides being formed by the rear walls of buildings fronting on French St. and the rear walls of number 931, 929 and the other buildings as far as the corner of Garrison St. and Penn Avenue. About a third of the way down to the entrance of the alley it narrowed to ten feet. The windows of the Pittsburgh Dry Goods Company looking down the alley were of plain glass in wooden frames and sash, but protected on every floor by tin-clad shutters securely hung and equipped with Holmes Electric Protection attachments to insure closing at night. The front and rear walls were of excess glass in wooden frames and sash.

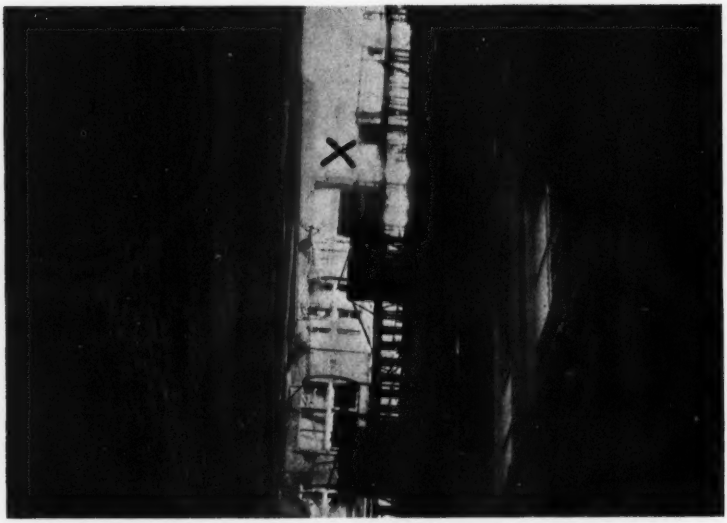
The floors were of double $\frac{7}{8}$-inch wood on joists supported by steel columns and girders largely unprotected. The roof was tin on wood sheathing. Elevators and stairways were enclosed in non-standard manner or equipped with automatic trap doors. The building was divided into three sections, with a standard brick fire wall between numbers 935 and 939, and a non-standard terra cotta wall between 939 and 943. All openings in the brick walls were protected by double, standard automatic tin-clad fire doors.

Story of the Fire.

The fire originated in number 931 in the section of the building occupied by William Perlman. There is some question as to whether it began on the 4th or 5th floor, but most probably on the 5th. The first alarm was sounded at 10:29 P.M. There was no watchman in the building. The alarm was turned in by an unknown person passing in the street who apparently discovered the fire after it had been burning some time. The cause of the fire will probably never be known. When the first engine companies arrived, within three or four minutes of the alarm, the fire had not escaped the confines of the building in which it had started, although it was burning furiously within the building.

The blind alley at the rear of the building acted as a flue, causing the fire, when it did break out of the rear of number 931, to spread to the rear of 929 and to burn the windows and shutters of 933. The firemen fought the fire from the tops of buildings backing into the blind alley and from the ground. Owing to the intensity of the fire and the draught caused by the alley, the fire spread to the upper floors of 929, where it was soon burning as fiercely as in 931.

Following the first alarm at 10:29 P.M. there were three regular alarms and four special calls, bringing into the fire area thirty pieces of apparatus. Twenty-four pumpers were brought to the scene, three salvage trucks, and three steamers. These were under the direction of the various captains, supervised by chief and deputies who arrived as follows: Deputy Chief and First Battalion Chief arrived on the first alarm; Chief of Fire Bureau arrived on second alarm; Second and Fifth Battalion Chiefs arrived on the third alarm. Eighteen pumpers and steamers were in active service. The other pumping



Looking up the alley towards the Pittsburgh Dry Goods Company building. Fire entered through a window at the point marked by the cross.

units were held in reserve, some of the personnel coöperating with the units in active operation.

A water tower, included in the equipment called to the scene, was not used in the early stages of the fire when it would have been most effective. When it was placed in service it was too late to confine the fire to the building of its origin. The fire was attacked mainly with hose streams, it having made strong headway before the arrival of the department. Hundreds of thousands of gallons of water were thrown into the burning buildings before the "Strike Out" signal was given at 5:45 P.M., Monday, October 17, 1927.

The building of the Pittsburgh Dry Goods Company was protected by a two-source standard automatic sprinkler system installed in 1899 and in 1903, largely wet pipe. There were three distinct systems: one supplied by city and gravity tank, and the others by city and pressure tanks. Maintenance was good, but spacing and pipe sizes were of the 1896 standard. All windows were protected by open sprinklers with control valves in the basement.

An employee of the Pittsburgh Dry Goods Company who had been working in his office since 5:30 P.M., hearing the fire engines and learning that the building next door was on fire, opened the valve in the basement controlling the open sprinklers on the Penn Avenue side and instructed the night watchman to open those over the windows in the alley on the west wall. Whether the watchman did this or not is not certain, as he cannot give a clear account of his movements at the time. The owners claim they were turned on, but the

firemen stated that they were never on at any time during the fire. Going through the building, the employee noticed the flames licking around the shutters protecting the windows in the west wall on the eighth floor. He knocked the fusible link from the sprinkler head near this opening. At about the same time a head on the seventh floor in the same vicinity opened automatically and the A. D. T. received a water flow alarm at 10:36 P.M.

At 11:03 the A. D. T. received a signal indicating that a gate valve of the sprinkler system was closed. A careful inquiry failed to locate any person who could verify this or indicate which valve was closed. The firemen claim no sprinklers were operating when they carried hose into the exposed section. The A. D. T. circuits are not designed to indicate specifically which valve is closed. No one will assume responsibility for the closed valve, and the most careful investigation has failed to reveal any inkling as to where, or by whom the valve was closed. The fire department was in full control of the premises at the time and it seems quite likely that one of their members shut off either the floor control valve on the eighth floor or the main valve in the basement to prevent further water damage. The special significance of this point is that the fire at this time had not yet gained any serious foothold in the building of the Pittsburgh Dry Goods Company.

The A. D. T. sheet shows that at 12:05 A.M. the closed valve was restored to normal open position. This seems to be verified by the operation of a sprinkler on the seventh floor caused by the fire burning through from the eighth floor. Water marks on the neighboring joists indicate flow from this head. As there seems to be little doubt that the eighth floor shutters looking into the alley were opened and the fire allowed to enter the building in this way, it is probable that it was at this time that the sprinkler gate valve was restored to normal open position—but too late, as probably all the sprinklers fused and the pressure at this height was insufficient. However, the fire at no time gained access to the seventh floor.

The Holmes Electric Protection records indicate that someone, presumably firemen, entered the rear windows of the Pittsburgh Dry Goods Company at 10:57 P.M. This action cut the circuits of their system so that no further signals were received. While no definite information has been obtainable, it is reported that the firemen opened the shutters in the west wall on the eighth floor in an effort to fight the fire from that point of vantage. The fire entered at this window, spreading through the floor, the intense heat fusing the sprinklers, rendering them useless, even if there had been sufficient pressure at that height.

Since the shutters on the seventh floor successfully resisted the fire, there seems little doubt that the eighth floor shutters were opened and the fire allowed to enter that floor of the Pittsburgh Dry Goods Company building. Apparently the heat waves were severe and the fire spread throughout this

Showing damage to the upper floors of the Pittsburgh Dry Goods Company building, looking from side of exposure fire which entered at point marked by cross.

floor of 933-935 quickly, and probably it was at this time that the sprinkler gate valve was restored to normal open position as noted above.

The entire floor of 933-935, its contents and the roof were burning furiously, the hose streams directed from behind the fire walls separating the annex from the main building having no practical effect. After burning fiercely for fifteen or twenty minutes, the fire had so affected the unprotected steel columns supporting the roof that they could no longer support its weight, together with that of the gravity tank installed there. This tank held 12,000 gallons of water and was a secondary supply to the sprinkler system. The steel buckled under the intense heat some time between 12:30 and one o'clock, causing the tank to fall. It tipped to the west and caused a large section of the west wall to collapse. The two fire captains who died later in hospitals received their fatal injuries from this collapse. The tank fell through the building, tearing huge holes in the floor, wrecking the sprinkler piping, damaging fixtures and merchandise on the lower floors, and finally breaking up on the second floor. Eye witnesses of the tank collapse state that the tank appeared to be full of water. It is therefore clear that the tank had not contributed to the flow from the sprinklers.

The entire eighth floor of 933-935 was destroyed, but the fire wall between 935 and 937, with double, standard fire doors on the openings, prevented the spread of the fire beyond 935. The water from hose streams directed into the eighth floor of 933-935, the water from the sprinklers, the water from the collapsed gravity tank, which apparently was full when it fell, and the water from the broken sprinkler riser and tank drop went through the floors of 933-943, thoroughly soaking practically all of the stock of the Pittsburgh Dry Goods Company and warping many floors and fixtures, causing a very heavy water loss.

The upper floors of 929 and 931 were completely gutted, and when the roof and upper floors collapsed they carried the lower floors through to the basement, resulting in total destruction of the interiors of both buildings, although the exterior walls, except for the windows and frames, were not seriously damaged.

In addition to the destruction of the buildings at 929 and 931, and the partial destruction of the building at 933-935, there was some fire damage done to windows and frames and fire escapes of the buildings at the rear of 929 and 931 facing French St. Also there was considerable water damage to floors, fixtures, and stock in buildings at 927, 937-43, and at 930-932 Penn Avenue (see diagram). The Salvage Company was unable or not equipped to cover and protect much of the stock in buildings affected by the fire.

To all the property owners concerned there was a total loss of $1,233,273.

Loss of Life.

Twelve firemen were injured during the fighting of this fire, the majority of the casualties occurring when the wall of No. 933 Penn Avenue collapsed at the time that the gravity tank fell owing to the softening of the unprotected steel supports. Of the twelve who were injured two died later in hospitals.

Conclusions.

The structure of the Pittsburgh Dry Goods Company was fairly well protected against an ordinary outbreak of fire. Had the tin-clad shutters on the alley been kept closed, the water tower placed in early operation, the sprinkler system not been interfered with, this building might have held its own against its burning neighbor.

The fire repeats the known lesson of the unreliability of unprotected steel, in particular where such steel work is heavily loaded by an elevated tank structure, erected after the building had been in use for a considerable length of time without having been taken into consideration in the original design of the building.

The very excessive water damage shows the need of sufficient salvage equipment in the fire department to protect the type and quantity of property

within its idstrict. It also proves that buildings used for such purposes as the Pittsburgh Dry Goods Company should have waterproofed floors and adequate scuppers, and that fire walls between sections should have raised sills to prevent the entering of water from a fire section to a section not involved.

The general lack of information as to the operation of the sprinkler system, particularly as to whether it had been shut off, emphasizes the need of definite knowledge on the part of the fire department of the details of each system; also that someone in authority should make sure that such systems are working during the fire and have an ample supply of water.

The blind court at the rear of the building in which the fire started evidently was responsible for the spread of the fire and proves again the hazard of vertical openings and the need of window protection in such locations.

Fires in Which There Was Loss of Life.

These notes are intended to point out typical conditions under which loss of life has occurred, that they may be known and guarded against.

Smoking in Bed.

L-174. HOLYOKE, MASS., NOVEMBER 27, 1927. A man fell asleep while smoking his pipe in bed. The bed clothing caught fire and he was suffocated.

Gasoline and Kerosene.

L-152. ALGONA, IOWA, OCTOBER 3, 1927. A woman was fatally burned when kerosene, which she threw on the smouldering coals in a heating stove, exploded and set fire to her clothing. She was able to extinguish the fire in her clothing, but was too weak to call for aid. Her son found her lying on the bed when he returned home. She was conscious, but her body from her chin down was severely burned.

L-156. HAMMONTON, N. J., OCTOBER 23, 1927. A nine-year old boy poured kerosene on some kindling wood in the kitchen stove and lighted it. An explosion followed which set fire to the house and burned the boy so badly that he died.

L-161. LEWISTON, MAINE, OCTOBER 30, 1927. Gasoline, which was used to kindle a fire in the stove, exploded. The mother, one of five seriously burned, died from her burns and the father was in a critical condition.

L-164. ST. PAUL, MINN., OCTOBER 24, 1927. A woman was burned to death in a gasoline explosion. In order to start a kerosene stove it was necessary to prime it with gasoline. She had gone to the basement with a small priming can to fill it with the gasoline when the explosion occurred. Her son was awakened by her screams and he tried to reach his mother. He was unable to do so and it was not until the fire was extinguished by the fire department that her body was recovered.

L-151. EAST ORANGE, N. J., OCTOBER, 1927. A woman was cleaning a piece of goods in her home with gasoline. The gasoline caught fire and she was fatally burned.

L-177. PORTLAND, MAINE, DECEMBER 1, 1927. A woman died from burns she received when an explosion of gasoline burned the clothing from her body. She was cleaning a winter coat and it is thought that the friction of rubbing the cloth ignited the flammable liquid.

H-25211. YONKERS, N. Y., DECEMBER 5, 1927. Ten gallons of gasoline was poured into a tub in the kitchen to be used to clean a sheepskin coat. There was a coal fire in the kitchen stove and the gasoline fumes ignited. An explosion followed in which one woman was burned to death and her husband was seriously burned.

Explosion of Paint.

H-25090. NEW YORK, N. Y., NOVEMBER 1, 1927. A suite on the eighth floor of a hotel was being redecorated when the fumes of a volatile varnish remover ignited. One of the workmen, who was working in the suite, made his way through the smoke and flames to a door leading to the corridor, where he was rescued by employees of the hotel. He was taken to the hospital, where he died from his burns. The other painter, who was badly burned by the explosion, removed his belt and buckled it around the iron framework of an awning. He thrust his arms through this belt-loop and leaned far out over the sidewalk while straddling the window ledge, dodging the smoke and flames until he was rescued by the fire department.

Fire Fighting.

H-25031. COLUMBUS, MISS., SEPTEMBER 23, 1927. Two firemen were killed and the chief seriously injured when a brick wall collapsed while they were fighting a fire in a cotton warehouse.

Fumes from Burning Film.

L-179. SOUTH BOSTON, MASS., DECEMBER 5, 1927. The fire department was called to fight a fire in a two-story dwelling, and for some time the firemen were not aware of what was burning. It was discovered that the occupant had collected rolls of old motion picture film and had stored them in a closet. The fire started when he lit a match in the closet while looking for some of the film. After the fire had been extinguished two of the firemen became seriously ill. They were taken to the hospital, where it was found that they were suffering from lung congestion which followed the inhaling of fumes from the burning nitrocellulose film. One fireman has since died and the other is in a serious condition.

Children Lose Way in Smoke.

H-25093. PEAPACK, N. J., NOVEMBER 8, 1927. Three children lost their lives when the dormitories of an orphanage were destroyed by fire while they were asleep. All of the children in one of the dormitories were rescued by a sister, with the exception of one who wandered off in the smoke toward the fire and was probably killed when a section of the floor gave way. In an adjoining dormitory two other children lost their lives when they wandered away in the smoke.

Children Alone in House.

H-25071. NEW YORK, N. Y., OCTOBER 11, 1927. Three children, who had been left alone on the top floor of a five-story tenement house, lost their lives when a fire, which started in the basement, spread up the dumbwaiter shaft. They were found suffocated in their apartment.

L-166. FT. DODGE, IOWA, NOVEMBER 11, 1927. A six-year-old girl climbed up on a chair to take something from the gas stove. A burner on the

stove was lighted and her sleeve caught fire. She started to run across the street where her mother was, when a neighbor who was passing pulled off his coat and wrapped it around her. The flames were smothered, but not before the little girl was fatally burned.

Explosion of Gas.

L-157. EMMETSBURG, IOWA, OCTOBER 26, 1927. Two children were burned to death when a fire, believed to have been caused by an explosion of gas in the kitchen stove, destroyed their home. The children were asleep on the second floor of their home and their parents were badly burned in an attempt to reach them.

Kitchen Stoves.

L-163. MOOSE JAW, SASK., OCTOBER 24, 1927. A fire, which is thought to have started from a small fire left burning in the kitchen stove when the family retired, caused the death of four people. A father and an uncle lost their lives when they attempted to rescue the two youngest children, who were also burned to death.

L-169. CONCORD, N. H., NOVEMBER 21, 1927. A mother and her three children were burned to death when fire destroyed their home. The mother made her way to the window with one of the children and dropped him out of the window. She then went back to save the other children; after the fire her body was found lying across the bed. The father had started a fire in the kitchen stove before he went to work and it is thought that the stove became overheated and set fire to a partition.

L-176. CLEBURNE, TEXAS, DECEMBER 1, 1927. A family of six people were burned to death when fire destroyed their home. Their bodies were found after the fire in the iron frames of three beds. It is thought that the fire started from coals falling from a stove which had been banked for the night.